# WARRANTY

THE SINGER COMPANY, METRICS DIVISION, warrants each new instrument to be free from defects in material and workmanship, effective after delivery to the original purchaser as follows:

*Sensitive Research* Electrical Indicating Instruments.....2 years
Other Electrical and Electronic Measuring Instruments.....1 year

Repair or replacement (at our option) without charge (F.O.B. factory) will be effected when our examination satisfactorily indicates that defects are due to workmanship or materials. Electron tubes, semiconductors, batteries, fuses, lamps, thermoelements, and *RatioTran* potentiometers are excluded from warranty coverage. Warranty returns must first be authorized by the factory.

If the instrument or any portion thereof, has been abused, misused, damaged by accident or negligence, or if any serial number or seal has been removed or altered, the warranty is void.

This warranty is in lieu of all other obligations or liabilities expressed or implied and The Singer Company neither assumes, nor authorizes any person to assume for them, any other liability in connection with sales of instruments manufactured by The Singer Company, Metrics Division.

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## REPAIR AND MAINTENANCE

Instruments should be returned only on prior written authorization from the Singer Representative or the factory(1). Warranty repair will be made upon written request. Please provide the following information in order to expedite our processing of your instrument:

1. Model or Type
2. Serial Number
3. Description of trouble(2)
4. Test instruments used
5. Approximate date instrument was placed in operation
6. Approximate number of hours of use
7. Has maintenance action been previously requested?
8. Other comments

Upon receipt of this information our Service Department will send you service data or shipping instructions. Upon receipt of shipping instructions forward the instrument to the factory prepaid. If requested, an estimate of charges will be made before work begins.

(1) Contact Metrics Division, 915 Pembroke St., Bridgeport, Connecticut for *Empire, Panoramic, and Sensitive Research* instruments.
Contact Metrics Division, 3211 S. LaCienega Blvd., Los Angeles, California for *Gertsch* instruments.
Contact Metrics Division, 7338 Varna Ave., N. Hollywood, California for *EMC* instruments.

(2) Include data on symptoms, measurements taken, suspected location of trouble, maintenance action taken, and any other relevant data.

May 1, 1964

# ADDENDUM TO NF-112

## I. PURPOSE

This addendum lists the differences between the equipment supplied and the information about the equipment in this instruction manual.

## II. ADDENDUM

The three main areas that have been changed are as follows:

a. Detector functions
b. Video output capabilities
c. Addition of 60 megacycle monitor point

The following pages and paragraph numbers list those areas where information should be changed or revised as indicated in this addendum.

A. Page 8 - Paragraph 2. 2d1
Revise to read as follows: The average position is utilized to obtain the average value of a CW signal.

B. Page 6 - Paragraph 2. 2d, 2. 2d2 & 2. 2d3
Revise paragraph 2 to read as follows: The peak switch position is used to measure peak values of incoming impulse, CW, or unmodulated CW signals. Readings are obtained in calibrated peak volts.

Revise paragraph 3 to read as follows: The slideback switch position is useful for measuring peak voltage where signal separation is required. This signal separation is required for meter accuracy. The accuracy of this test depends on the operator's judgement. The meter reads directly in peak volts.

C. Page 33 - Paragraph 4. 2. 3
Change to read as follows: Schematic diagram 61201 shows the attenuator, the 60 mc IF output filter and connector in the lower left-hand corner. Note that R889, a 470 ohm resistor, is employed to isolate the output of the 60 mc attenuator from the filter input. This isolation prevents a change in system performance when the output connector is terminated. The IF output filter is a low-pass filter.

D. Page 36 - Paragraph 4.2.6

Revise paragraph 3 to read as follows: The D.C. voltage at the slider of potentiometer R795 is a direct measurement of the peak amplitude of an incoming pulse. This voltage measurement permits aural detection of a peak level. The voltage measured by the meter is a direct measurement of the peak level of the incoming signal at the point where the aural indication just vanishes (see figure 4-6 in this addendum).

E. Page 36 - Paragraph 4.2.6.1

See figure 4-6 in this addendum.

Revise paragraph title to read as follows: Average detector position

Revise paragraph to read as follows: Silicon diode CR709 serves as an average detector in a conventional detector circuit. In this mode of operation, the only source of current to the meter is the output of diode detector CR709. The diode is provided with a slight amount of forward bias voltage for the purpose of improving linearity at low signal levels. This bias voltage is regulated by diode CR705. The bias source is a rectified 6.3 volts obtained from filter rectifiers CR708 and C832.

F. Page 38 - Paragraph 4.2.6.2

Revise paragraph title to read as follows: Peak detector position.

Revise paragraph to read as follows: In the peak switch position it is necessary that both peak levels of impulse signals and CW signals be read. Figure 4-6 shows that in peak position 2, both the output from the D.C. or CW detector and the A.C. coupled electrometer are summed in the front panel meter. These outputs are balanced so that correct and related readings are obtained in either CW or impulse input conditions. The time constant of the diode detector is very short; thus, modulations at low audio frequencies are not seen by this detection. To read modulation peaks, a long time constant modulation detector is employed at the output of the video detector where modulation is also summed across the meter. The net result of these summations is a true indication of the absolute peak value of any type of incoming signal. Schematic 61201 shows the detailed circuits involved. The balance to unbalance converter serves only to convert the differential voltage from the electrometer circuit to a signal output referenced to ground level so that summing can be achieved.

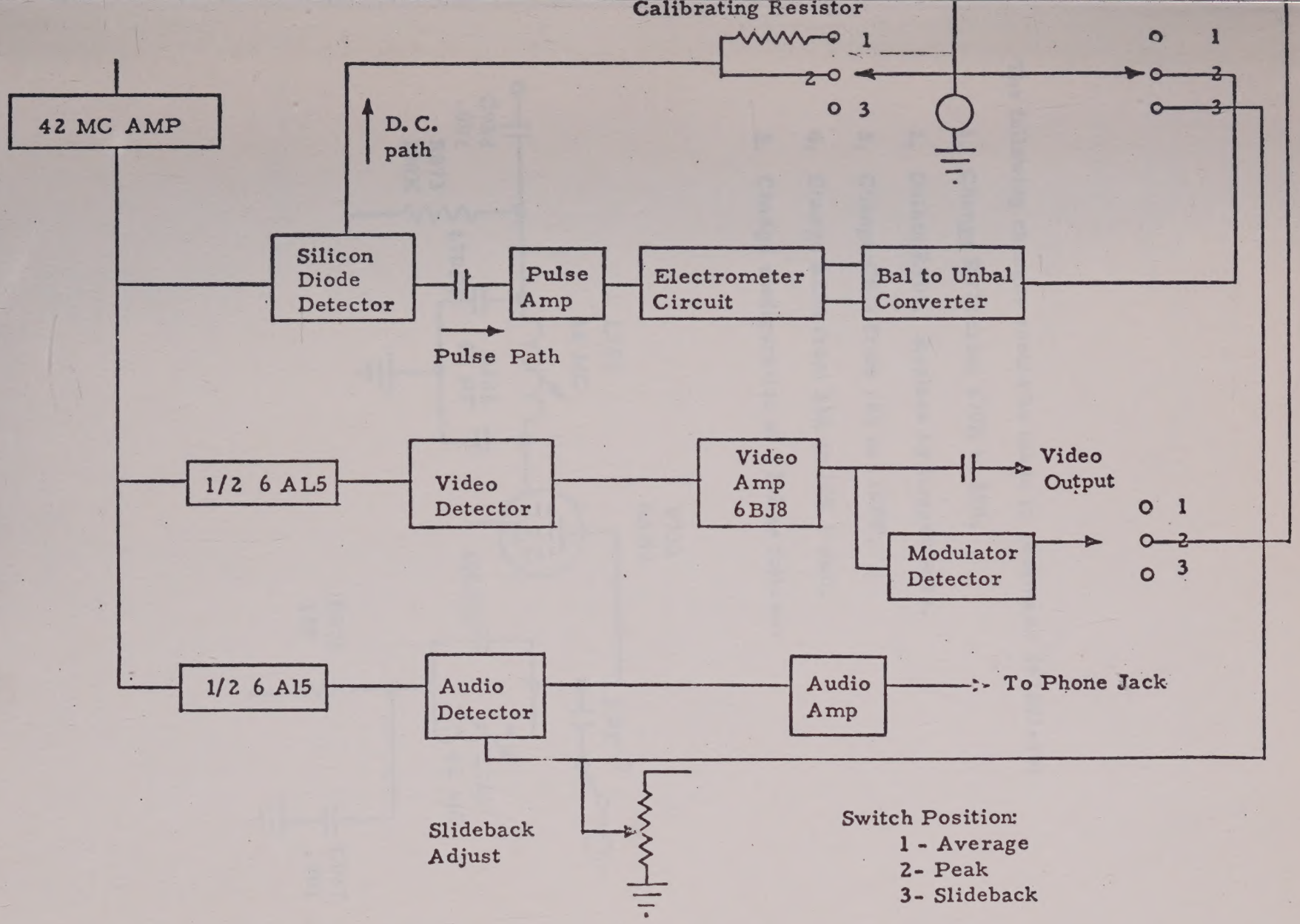
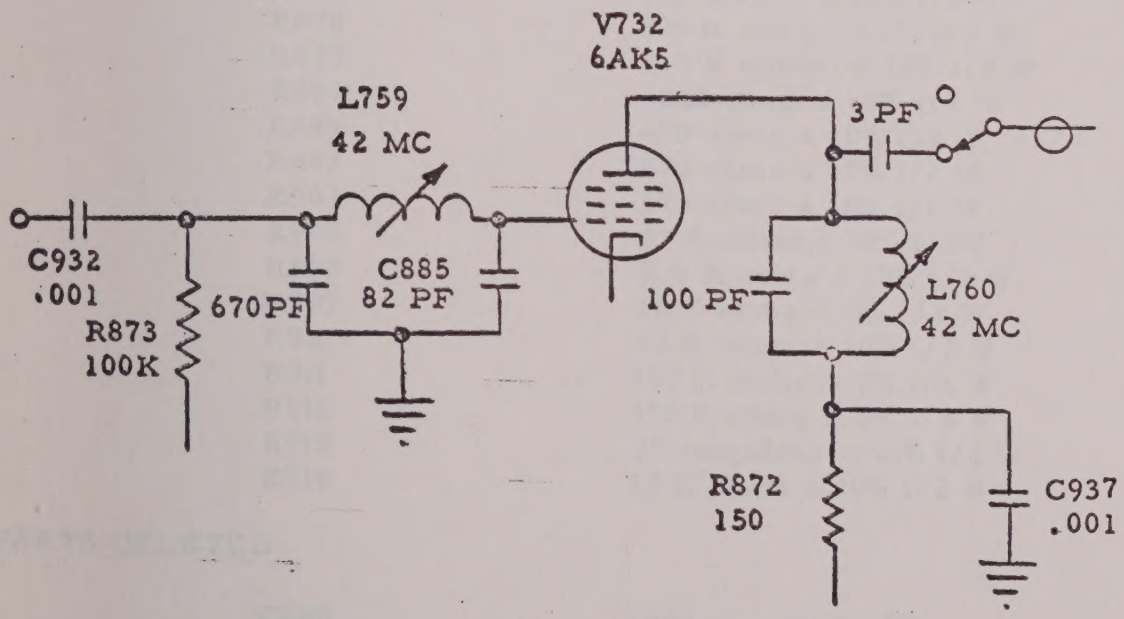



Figure 4-6 (Revised) Detector Function Block Diagram - 42 MC Amplifier Chassis.

The following changes should be made to schematic 061201-15:

1. Change R772 from 470K to 22K.
2. Delete R909. Replace by jumper wire.
3. Change C819 from .05 to .10PF.
4. Change R884 from 33K to 10K 1 watt.
5. Change configuration of V732 as follows:



## III. ADDEMDUM TO PARTS LIST

The following lists pertain to parts in this unit which have been added, deleted, and changed.

### A. PARTS ADDED

| Ref. Symbol | Description |
|---|---|
| C832 | 100 mfd, 15 V |
| C871 | .001 ufd |
| C883 | 5 pf |
| C886 | 2 pf |
| C887 | 10 ufd, 100V |
| CR705 | IN251 |
| CR708 | IN251 |
| CR709 | IN251 |
| CR711 | IN34A |
| Q704 | 2N1711 |
| Q705 | 2N1711 |
| R830 | 47 ohms, ± 10% 1/2 W |
| R831 | 15K ohms, ± 10% 1/2 W |
| R878 | 100 K ohms, ± 5% 1/2 W |
| R879 | 4.7 K ohms, ± 10% 1/2 W |
| R884 | 33 K ohms ± 10% 1/2 W |
| R889 | 470 ohms ± 10% 1/2 W |
| R893 | 470 ohms ± 10% 1/2 W |
| R903 | 270 ohms ± 10% 1/2 W |
| R904 | 47 K ohms ± 10% 1/2W |
| R908 | 3.9 K ohms ± 10% 1/2 W |
| R909 | 68 K ohms ± 5% 1/2 W |
| R910 | 22 K ohms ± 10% 1/2 W |
| R911 | 100 K ohms ± 5% 1/2 W |
| R912 | 150 K ohms ± 5% 1/2 W |
| R913 | 27 megohms ± 10% 1/2 W |
| R914 | 12 K ohms ± 10% 1/2 W |

### B. PARTS DELETED

| | |
|---|---|
| C808 | 1000 pf, stand-off |
| C809 | 5 pf , tubular ceramic |
| C810 | 10 pf, tubular ceramic |
| C811 | 100 pf, tubular ceramic |
| C817 | 20 mfd, 15V |
| C818 | 1000 pf, stand-off |
| C833 | 20 mfd, 15V |
| C851 | 1000 pf, stand-off |

Parts deleted - cont.

| | |
|---|---|
| C938 | 1000 pf, feed-thru |
| C939 | 10 pf, tubular ceramic |
| R760 | 1.2 K ohms, ± 10%, 1/2 W |
| R764 | 20 K ohms, ± 1%, 1/2 W |
| R765 | 22 K ohms, ± 1%, 1/2 W |
| R766 | 470 K ohms, ± 10%, 1/2 W |
| R768 | 390 ohms, ± 10%, 1/2 W |
| R769 | 15 K ohms, ± 10%, 1/2 W |
| R770 | 560 ohms, ± 10%, 1/2 W |
| R771 | 470 ohms, ± 10%, 1/2 W |
| R907 | 27 K ohms, ± 10%, 1/2 W |

C. PARTS CHANGED

| Ref. Symbol | From | To |
|---|---|---|
| R783 | 1.2 ohms, ± 10%, 1/2 W | 12 K ohms, ± 10%, 1/2 W |
| R799 | 78 K ohms, ± 1%, 1/2 W | 134 K ohms, ± 5% 1/2 W |
| R902 | 390 ohms, ± 10%, 1/2 W | 1 K ohm, ± 10%, 1/2 W |
| V721 | 12AT7 | 6DJ8 |

# ERRATA

On page 22: In place of paragraph 3.5.3 and associated figures 3-7 and 3-8 substitute the following paragraph:

3.5.3 Measurement in Accordance with Specification MIL-I-26600

The latest issue of specification MIL-I-26600 establishes the following limits for radiated interference.

Narrow Band (CW) Radiated Limit: 60 DB above 1 uv per meter at 3 feet.

Broadband and Pulsed CW Radiated Limit: 80 DBMC per meter at 3 feet.

In order to determine whether the equipment under test satisfies these limits, use the procedures given in preceding paragraphs 3.1 through 3.4.2, employing the antenna and its antenna factor as indicated by paragraphs 3.5 through 3.5.2, and spacing the nearest point on the "dish" 3 feet from the equipment under test. Then, compare the resulting field strength to 60 DB above 1 microvolt/meter for Narrow Band (CW) Radiated energy, or 80 DBMC/meter for Broadband or Pulsed CW Radiated energy.

On page 27, paragraph C, line 9: delete "+6.3 volts" and substitute "+6.0 volts".

On page 29, 2nd paragraph, line 6: change sentence to read, "The signal is then coupled from the second cavity to the crystal mixer, which employs a type MA421B silicon diode for RF bands 1 and 2, a 1N21E for band 3, and a 1N23E for band 4."

On page 40, section 4.2.9, line 2: delete "+6.3" and substitute "+6.0".

On page 42, output lead, lower right "Regulating Circuit" block: delete "+6.3V (I.G.)" label and substitute "+6.0V".

On page 43, line 3: delete "16.3 volt impulse generator" and substitute "+6.0 volt".

On page 45, paragraph 5.1.1-b: delete "+6.3V" and substitute "+6.0V".

On page 53, paragraph 5.2.1, directly following the heading: add the statement, "These potentiometers should never require readjustment unless they are burned or replaced."

On page 53, paragraph 5.2.1: change step "b" to read, "Connect an ohmmeter between terminals 2 and 3 of the low limit potentiometer (nearest the rear of the tuning unit) and turn the tuning control to its lower frequency limit."

ADDENDUM

to

NF-112 MANUAL

I. PURPOSE.

To update the existing manual to reflect the addition of a 348 MC Preamplifier in the Model T-1, T-2, T-3 and T-4 Tuning Units and the modification of the local oscillator chassis in the Model BA-112 Basic Measuring Unit.

II. ADDENDUM.

The following page and paragraph numbers list those areas where information is to be changed as indicated in this addendum.

A. Page 25, Para. 4.0 - - - Change sixth paragraph to read:

". . . . Mixed with a 408 MC L.O. signal generated by a 102 MC crystal-controlled oscillator and frequency multiplier."

B. Page 26, Figure 4-1 - - - Revise illustration as indicated in figure I.

C. Page 28, Figure 4-2 - - - Revise illustration as indicated in figure II.

D. Page 30, first paragraph - - - Change to read:

" The 348 MC output of the mixer is fed to a 348 MC preamplifier in the tuning unit. The direct current component of the mixer output is returned to ground through a biasing diode in the T-1, T-2 and T-3 Tuning Units and through a biasing resistor in the T-4 Tuning Unit. The output of the 348 MC preamplifier is then applied to the 348 MC postamplifier in the basic unit."

E. Page 31, Para. 4.2.1 - - - Change first paragraph to read:

". . . . Its function is to amplify the signal from the 348 MC preamplifier within the tuning unit to a level sufficiently strong

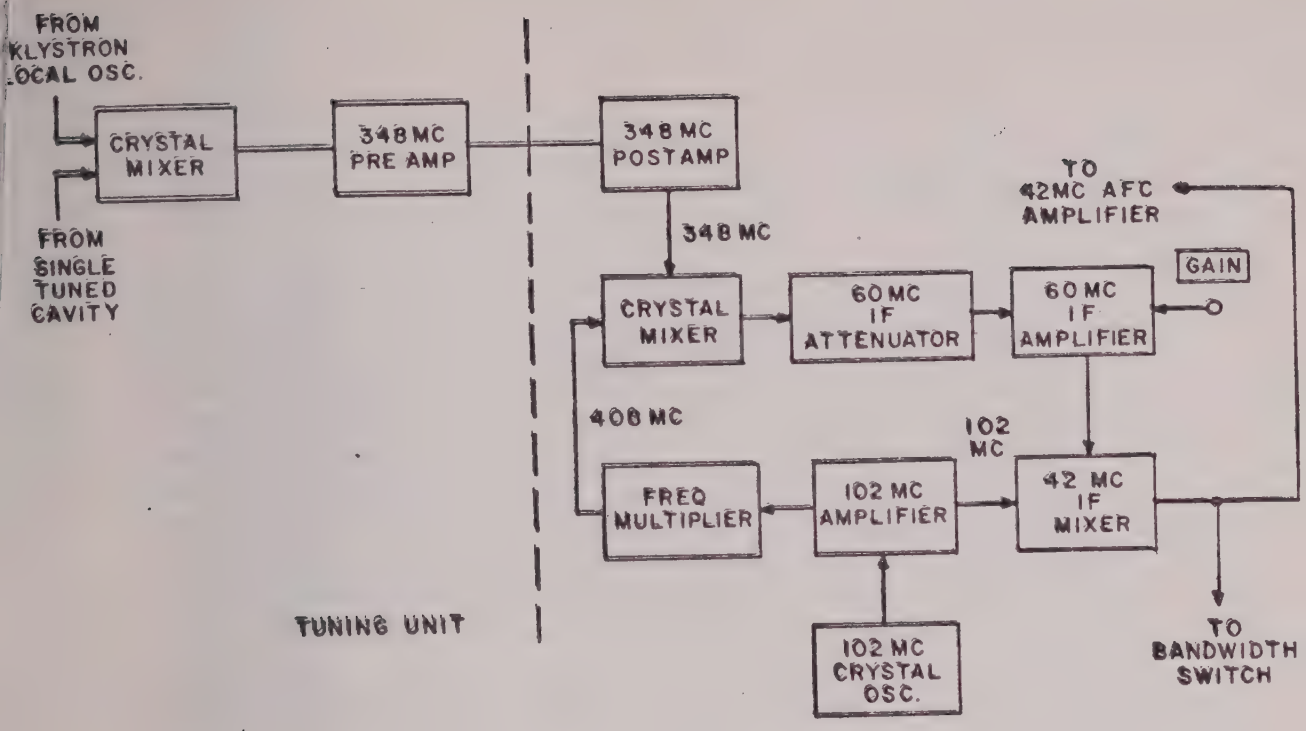



Figure I - Modification for Figure 4-1

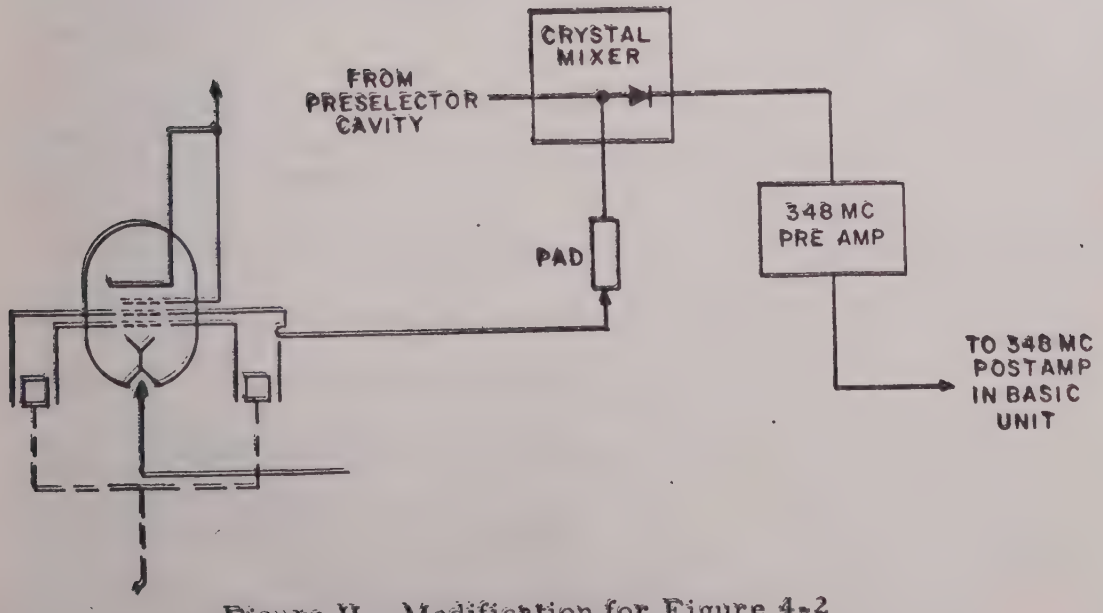



Figure II - Modification for Figure 4-2

as to - - - -"

F. Page 40, Para. 4.2.8 - change to read:

"The Local Oscillator Chassis is located on the left side of the hinged plate. It consists of crystal-controlled oscillator V711 (6AH6) which generates a signal at 102 MC. This signal is coupled through 2.2 pico-farad capacitor C917 to 102 MC amplifier V712 (6AU6). Part of the output of V712 is coupled from the low-impedance secondary winding (L788) through J710 and applied to the 42 MC mixer in the 60 MC IF amplifier; the signal is also coupled through 6.8 pico-farad capacitor C910 to frequency multiplier V713 (6J4). The 408 MC output of the frequency multiplier is coupled through a coaxial type tuned circuit to the 348 MC mixer in the 60 MC preamplifier chassis."

G. Page 41, Figure 4-8 --- Revise as illustrated in figure III and change caption to read:

"Figure 4-8. Local oscillator"

H. Page 48, Para. 5.1.3.1 - - - change to read:

"a. Remove the cover. Disconnect P1 from J708 of the 60 MC IF amplifier chassis and connect P1 to an Empire Devices Model NF-105 Noise and Field Intensity Meter which is tuned to 102 MC.

b. Fine tune the Model NF-105 to obtain a maximum meter indication.

c. Alternately adjust L720 and L721 on the local oscillator chassis to obtain a maximum indication of the Model NF-105 (2.5 volts, minimum).

d. Rotate the tuning slug of L720 one-quarter turn counterclockwise.

e. Disconnect the Model NF-105 and reconnect P1 to J708."

I. Page 59 - - - Add the following paragraph:

"5.2.4 348 MC PREAMPLIFIER ALIGNMENT.

a. Turn the POWER switch to OFF.

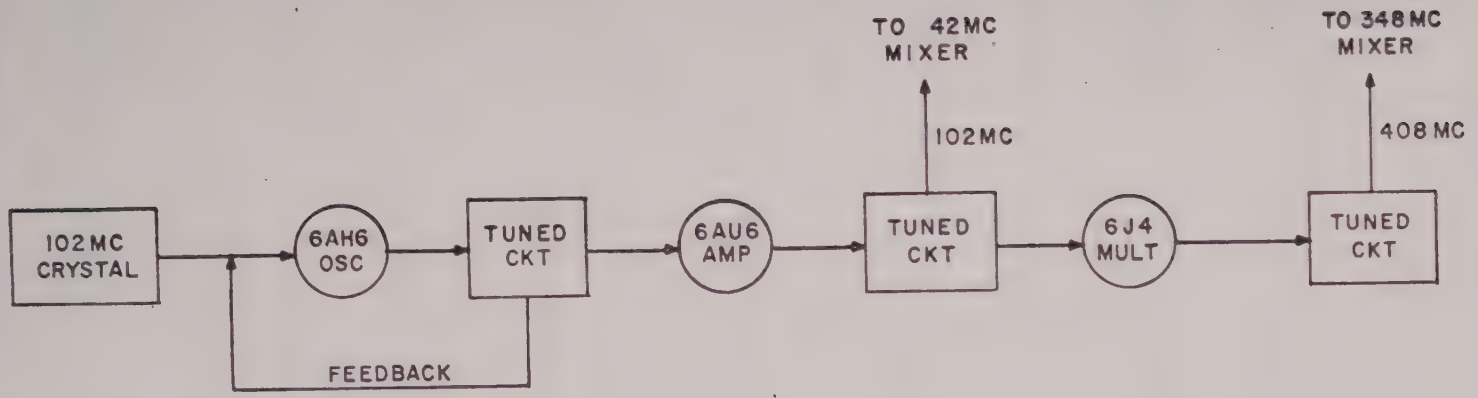



Figure III - Modification for Figure 4-8

b. Connect a signal generator ( through a 6-db pad ) to J1 of the 348 MC preamplifier. Do not energize the signal generator.

c. Set the POWER switch to STANDBY and, allow a few minutes for warm-up.

d. Set the SIGNAL INPUT ATTENUATOR switch to ODB and adjust the GAIN control for a half-scale indication of noise on the front panel meter.

e. Tune the signal generator to 348 MC and set for minimum output level. Energize the signal generator and allow a few minutes for warm-up.

f. Increase the signal generator output level to obtain a full scale meter indication.

g. Set the SIGNAL INPUT ATTENUATOR switch to 20 DB and alternately adjust C2 and C6 to maximize the meter indication.

h. Adjust C7 to maximize the meter indication.

i. Alternately adjust C6 and C7 to maximize the meter indication.

j. Adjust C1 to maximize the meter indication.

k. Adjust C2 to maximize the meter indication.

l. Alternately adjust C1 and C2 to maximize the meter indication.

m. Repeat steps i and l.

n. Turn the signal generator off and set the POWER switch to OFF.

o. Remove the signal generator and pad and connect the first mixer output cable to J1 of the 348 MC preamplifier.

p. Connect a microwave signal generator to the SIGNAL INPUT connector of the basic unit. Tune the signal generator to any frequency within the range of the tuning unit.

q. Set the POWER switch to STANDBY and energize the signal generator. After a few minutes warm-up, set the POWER switch to ON.

r. Tune the tuning unit to obtain a maximum meter indication.

**s.** Adjust C2 to obtain a maximum meter indication.

**t.** Alternately adjust C1 and C2 only to obtain optimum sensitivity (best signal-to-noise ratio)."

ADDENDUM

for

MODEL NF-112

PURPOSE.

To update the instruction manual to reflect the latest modification to the equipment and to provide additional data not contained therein.

I. DESCRIPTION.

1. There are two BNC connectors located on the lower right hand side of the front panel. Both are IF OUTPUT connectors, one for the 60 MC pre IF OUTPUT and the other for the 42 MC post IF OUTPUT.

2. Figures E16-1 and E16-2 are antenna factor graphs which exclude the cable loss. Figure E16-3 is a graph of the 6 foot cable loss which is included in Figures 3-5 and 3-6 of the instruction manual.

3. Power bandwidths at the 3, 6 and 12 db down points in the NARROW and WIDE positions of the BANDWIDTH switch are given in Table E16-1.

TABLE E16-1. POWER BANDWIDTH IN MC

| DB DOWN | BANDWIDTH POSITION | |
|---|---|---|
| | NARROW | WIDE |
| 3 | | |
| 6 | | |
| 12 | | |

SERIAL NO.

4. On pages 17 and 18, modify paragraph 3.4.2 to read as follows:

3.4.2 Aural Slideback Method

Although the Direct Reading calibrated method covered above will be used for the vast majority of measurements, in the event that the signal input consists of pulses at an extremely slow repetition rate, the following slideback method might prove more suitable.

Turning the Slideback control, located on the front panel (right side), varies the bias which is applied to a separate slideback detector. This produces a clipping action so that this detector passes only those signals which exceed the bias level; as a result, background noise is removed, allowing only the peaks of pulses to be heard. By increasing the slideback bias so that only the peaks are barely audible (after the equipment is calibrated at the frequency of measurement) it is possible to accomplish accurate measurement of very low repetition rate pulsed signals. To make slideback measurements, first calibrate the equipment at the frequency of measurement and then coninue as follows:

| Control | Position |
|---|---|
| SLIDEBACK | Fully counterclockwise |
| VOLUME | Mid-position |
| IMPULSE GENERATOR | OFF |
| READ-CALIBRATE | READ |
| FUNCTION SWITCH | SLIDEBACK |
| BANDWIDTH | WIDE |

a. The SIGNAL INPUT ATTENUATOR should be set at the highest level which will permit monitoring the unknown signal by means of a headset plugged into the PHONES connector.

b. Adjust the SLIDEBACK control until the signal is just barely audible.

c. Note the meter indication and determine the signal strength by adding the amount of r-f attenuation inserted.

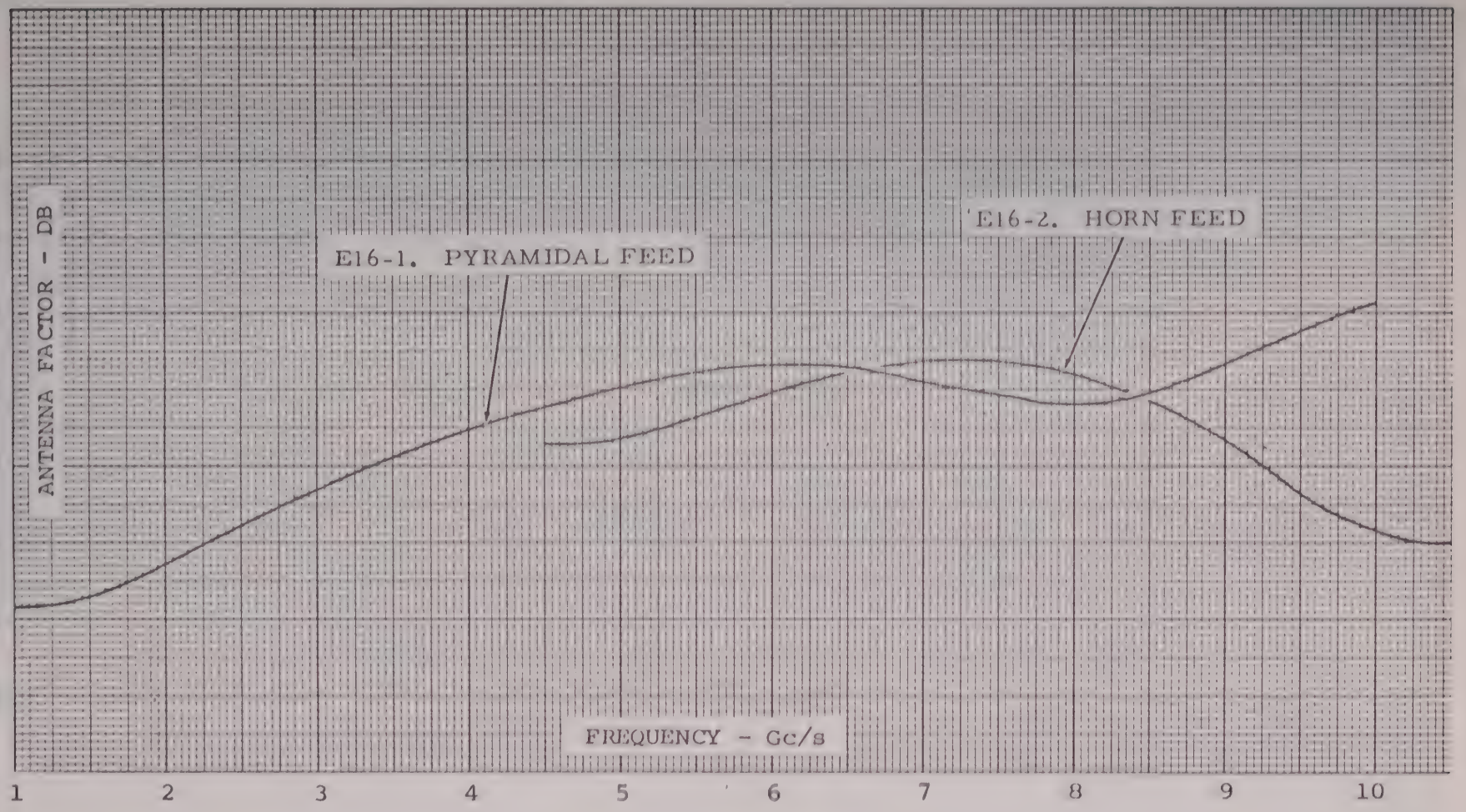



Figure E16-1 & 2. Antenna Factors - Pyramidal Feed and Horn Feed Without Cable.

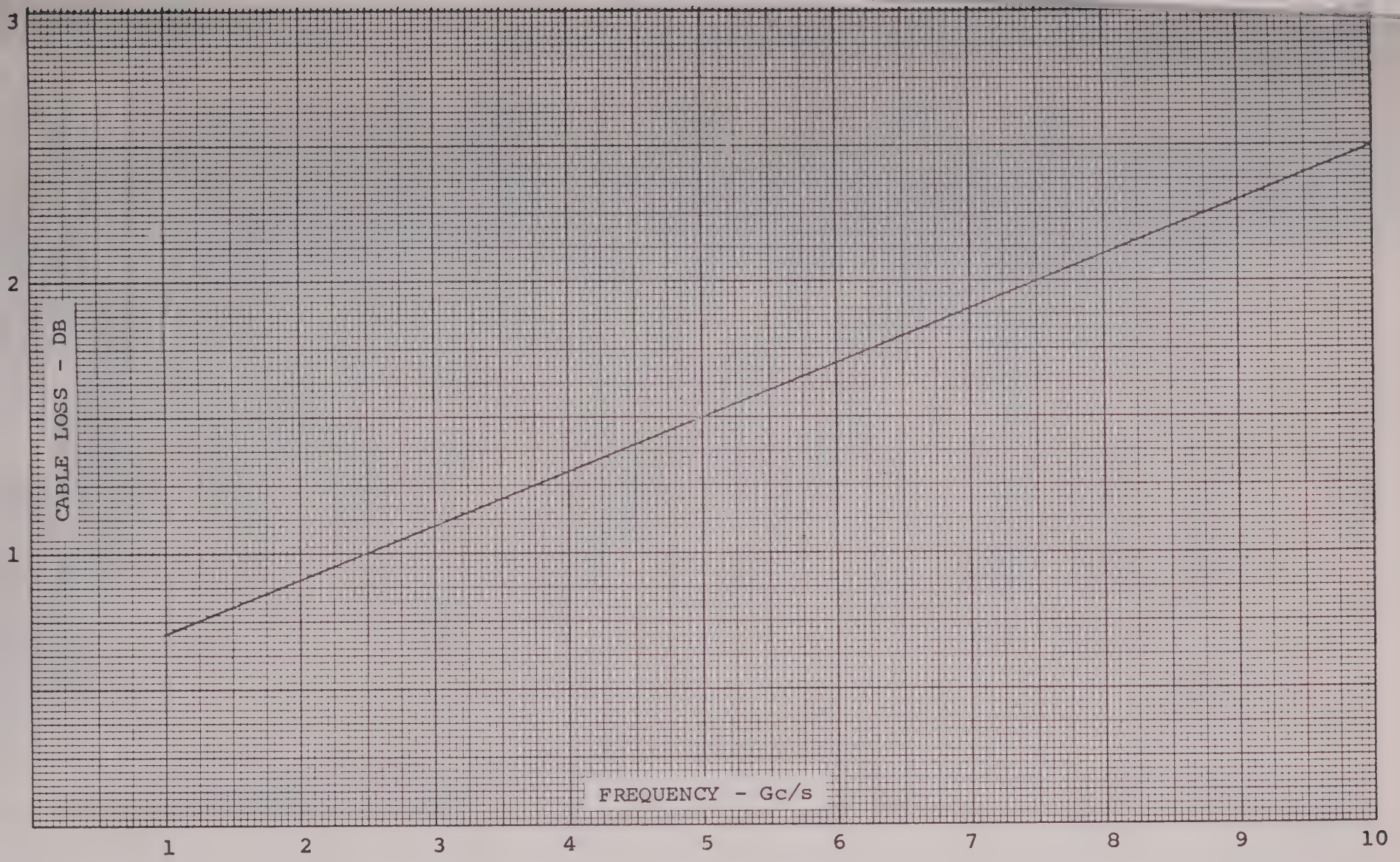



Figure E16-3. Cable Loss for 6 Foot of RG-9A/U Cable in DB vs. Frequency.

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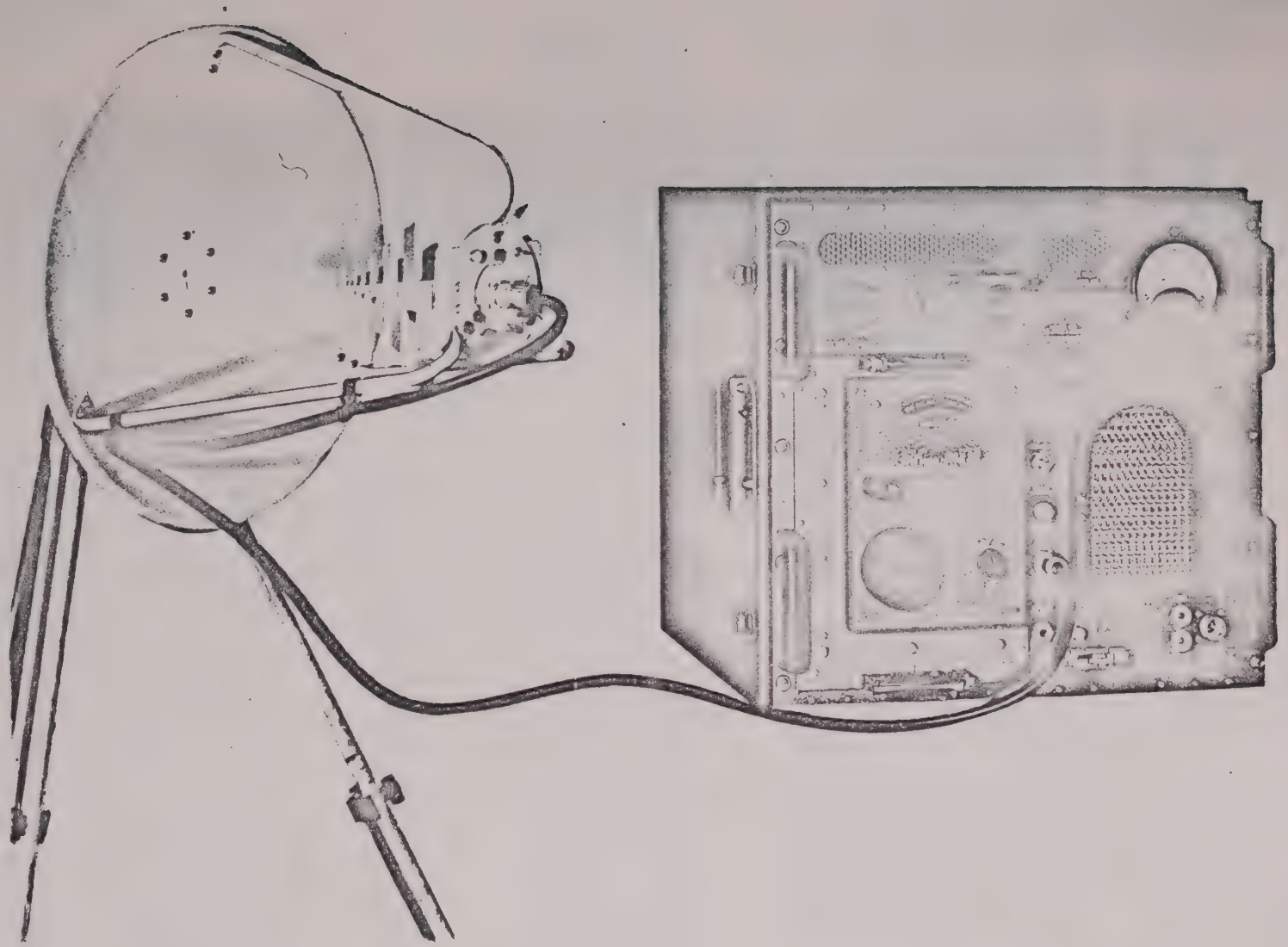


EMPIRE NOISE & FIELD INTENSITY METER, MODEL NF-112

# PART ONE - INTRODUCTION

## SECTION I

## DESCRIPTION OF NOISE AND FIELD INTENSITY METER MODEL NF-112

### 1.1 General

Noise and Field Intensity Meter, Model NF-112, is intended for use in the frequency range from 1.0 to 15.0 KMC. This frequency range is covered by means of five plug-in tuning units which house the RF circuits, including the pre-selector, RF mixer, and local oscillator. (This portion of the manual covers 1-10 KMC; Tuning Unit T5, which covers 10-15 KMC, will be treated separately.) The circuits common to all frequency ranges are contained in the Basic Measuring Unit. These include attenuators, detectors, IF amplifiers, the impulse generator, metering circuits and the power supply. The standard accessory kit includes the broadband directional antenna, antenna cable, and a tripod. A broadband omni-directional antenna, a remote indicator meter, carrying cases to protect the tuning units in transit, and an alignment harness are available as optional equipment.

### 1.2 Application

Noise and Field Intensity Meter, Model NF-112, is a compact, portable instrument. Although its primary function is measurement of field intensity, it is ideally suited for quantitative determination of spurious frequency outputs of transmitters and local oscillator radiations of receivers. It may also be used as a sensitive RF vacuum tube voltmeter and a tunable, high-sensitivity null detector. The frontispiece shows the instrument with one of its tuning units and with the broadband directional antenna, Model AT-112, connected for radiated measurements.

### 1.3 Technical Characteristics

FREQUENCY RANGE: 1.0 to 15.0 KMC covered by means of five plug-in tuning units containing the RF circuits.

| Tuning Unit | Actual Coverage |
|---|---|
| T-1/NF-112 | 0.85 to 2.1 KMC |
| T-2/NF-112 | 2.0 to 4.0 KMC |
| T-3/NF-112 | 3.9 to 7.1 KMC |
| T-4/NF-112 | 7.0 to 10.2 KMC |
| T-5/NF-112 | 10.0 to 15.0 KMC |

POWER REQUIREMENTS: 115 volts, 50 to 400 cycles, 580 va.

VOLTAGE REGULATION: Plate and filament supply fully regulated for operation from 105 to 130 volts.

VOLTAGE RANGE AS A TWO-TERMINAL RF VOLTMETER: Carrier Intensity Measurements: 10.0 microvolts to 1.0 volt: extension to 10 volts may be achieved by use of a 20 DB pad, type AT-160 (optional).

Noise Measurements:

$\frac{10}{\text{Bandwidth (MC)}}$ uv/MC to $\frac{1.0}{\text{Bandwidth (MC)}}$ volts/MC

EFFECTIVE IMPULSE BANDWIDTH RATIO: A nominal difference of 14 DB between wide band and narrow band setting on front panel.

INPUT IMPEDANCE: 50 ohms

INPUT RF CONNECTOR: Type "N", female

CALIBRATION: Broadband impulse noise generator. Fixed Pulse Repetition Rate of 400 CPS.

WAVEFORM MEASUREMENT CAPABILITY:

| Modulation | Function Switch Position | Voltage Measured |
|---|---|---|
| 1. CW unmodulated | "CW Average" | RMS |
| 2. Amplitude-modulated | "CW Average" | RMS |
| | "CW Peak" | .707 Peak Value |
| 3. Pulse-modulated | "Pulse Peak" | Peak Value |
| 4. Broadband noise | "Pulse Peak" | uv/mc |

INDICATING METER: 4-1/2 inch logarithmic movement calibrated in microvolts (5 to 100) and decibels (+14 to +40)

BASIC CONSTRUCTION: For field use in accordance with rigid military standards. A rubber gasketed cover furnished as part of the instrument, renders it splashproof and protects the controls and indicators.

SIZE: 19-9/16 inches wide x 18-1/2 inches high x 21-1/2 inches deep.

WEIGHT: Approximately 150 pounds, including any one of the tuning units.

1. NF-112 w/ TUNING UNIT T4/NF-112
2. TUNING UNIT T3/NF-112
3. TUNING UNIT T2/NF-112
4. TUNING UNIT T1/NF-112
5. ACCESSORY CARRYING CASE, AC-112
6. ANTENNA, AT-112
7. HORN-FEED FOR AT-112
8. SPANNER WRENCH, TK-112
9. ALIGNMENT TOOL, TL-112
10. TRIPOD, TP-112
11. EARPHONES, EA-112
12. POWER CORD
13. REMOTE METER, RE-112
14. REMOTE METER CABLE, RC-112
15. INSTRUCTION MANUAL
16. TUNING UNIT CARRYING CASE, TC-112

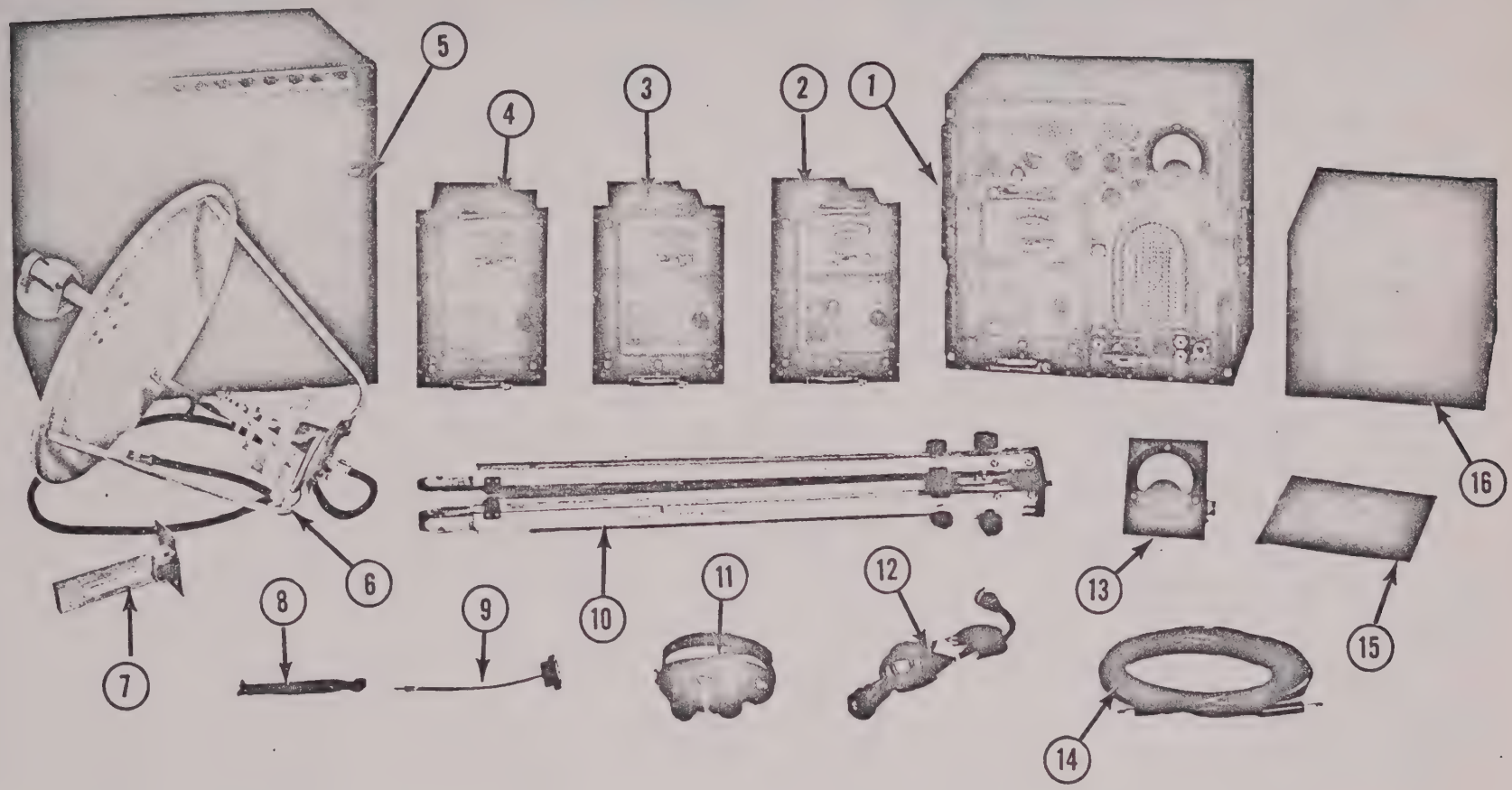



FIGURE 1-1. NF-112 WITH ACCESSORIES

## 1.4 List of Components

Noise and Field Intensity Meter Model NF-112 consists of the components listed below:

| Quantity | Name of Component | Catalog No. | Dimensions (in) Height | Width | Depth |
|---|---|---|---|---|---|
| 1 | Basic Measuring Unit | BA-112 | 18-1/2 | 19-9/16 | 21-1/2 |
| 1 | Tuning Unit (1-2 KMC) | T-1/NF-112 | 11-1/2 | 8-3/4 | 17-1/4 |
| 1 | Tuning Unit (2-4 KMC) | T-2/NF-112 | 11-1/2 | 8-3/4 | 17-1/4 |
| 1 | Tuning Unit (4-7 KMC) | T-3/NF-112 | 11-1/2 | 8-3/4 | 17-1/4 |
| 1 | Tuning Unit (7-10 KMC) | T-4/NF-112 | 11-1/2 | 8-3/4 | 17-1/4 |
| 1 | Tuning Unit (10-15 KMC) | T-5/NF-112 | 11-1/2 | 8-3/4 | 17-1/4 |
| 5 | Carrying Case for Tuning Unit | TC-112 | | | |
| 1 | Alignment Harness | AH-112 | | | |
| 1 | Standard Accessory Kit (1-10 KMC) consisting of the following items: | KT-112 | | | |
| 1 | Antenna, Broadband Directional | AT-112 | | | |
| 1 | Input Cable | CB-112 | | | |
| 1 | Tripod | TP-112 | | | |
| 1 | Earphones | EA-112 | | | |
| 1 | Accessory Carrying Case | AC-112 | 21 | 22 | 22 |
| 1 | Tripod Bag | BG-112 | 30 | 4 | 5 |
| 1 | Spanner Wrench (Klystron removal) | TK-112 | | | |
| 1 | Remote Indicator | RE-112 | 4-1/2 | 4-5/8 | 4-1/2 |
| 1 | Remote Indicator Cable (25 ft) | RC-112 | | | |
| 1 | Antenna, omni-directional | BB-112 | | | |
| 1 | Alignment Tool | TL-112 | | | |

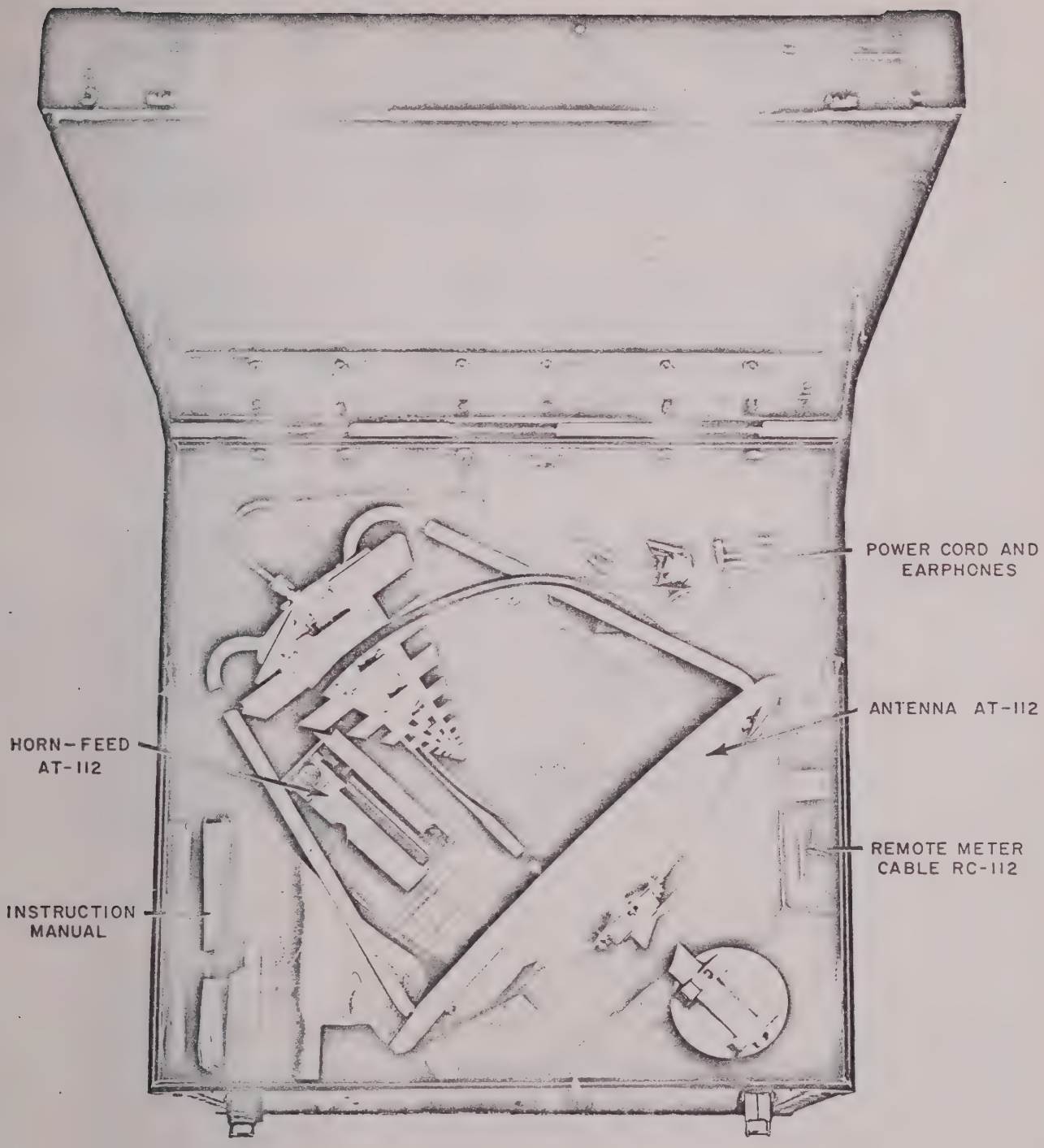



FIGURE 1-2. ACCESSORY CARRYING CASE, MODEL AC-112

## 1.5 Description of Major Components

The Basic Measuring Unit, BA-112, contains all circuits and components not unique to the RF tuning ranges of the plug-in heads. The principal components include the RF and IF attenuators, the 348 MC IF amplifier, the 60 MC preamp and IF amplifier, the 42 MC IF amplifier, all metering circuits, audio, AFC circuits, the impulse generator, the blower, and the power supply. Mechanical construction is of rugged, structually-reinforced aluminum. All orifices are carefully RF shielded through extensive use of RF gaskets and waveguide-below-cutoff designs.

The RF Tuning Units contain all circuits unique to their respective frequency ranges, including linear tuning dial, preselectors, mixers, local oscillators, and RF filters. These units feature a unique and reliable mechanism which insures accurate tracking of preselector and klystron cavity over the wide frequency range of each unit, thus insuring optimum sensitivity and spurious rejection characteristics. The same painstaking attention to RF shielding applied to the basic unit is equally apparent in the design of these "heads". Particularly important are the mechanical features which permit rapid changing of tuning units without any sacrifice of this high degree of shielding effectiveness.

Broadband Directional Antenna, AT-112 consists of a parabolic reflector with a pyramidal log-periodic feed assembly. This single antenna covers the entire frequency range from 1.0 to 10.0 KMC without requiring any adjustments or substitution of components. However, for the exceptional cases where the highest possible sensitivity is required in the frequency range above 6.0 KMC, a special horn feed included in the accessory kit may be substituted, by a simple operation involving only four thumb screws and the RF connection.

Broadband onmi-directional antenna, BB-112, is useful for spectrum surveillance applications over the entire 1.0 to 10.0 KMC frequency range; however, for quantitative measurements, the directional antenna, Model AT-112, discussed above, must then be employed.

## SECTION II

## ASSEMBLY AND PRELIMINARY SET-UP

### 2.1 Assembly and Interconnections

Ascertain that the plug-in tuning unit covering the desired frequency range is inserted in the main unit. If not, loosen the two latches, one each at the top and bottom of the tuning unit already installed, by exerting pressure on each latch sufficient to trip the spring release mechanism. Exercising care appropriate to a precision mechanism weighing 30 pounds, use the handle to pull the installed tuning unit forward, placing one hand under and supporting the extended portion before extraction is completed. Next, insert the desired tuning unit, after opening its latches straight out so as to avoid the inconvenience of having to open them during the installation process. The installation process is then completed by closing the top and bottom latches.

Remove from the accessory case those of the following items required:

a. AC Line Cord. This cord leads from the AN connector located in the lower right-hand corner of the main unit front panel to the 115 volts, 50 to 400 cycle power source.

b. Remote Indicator, RE-112. In certain instances, it may be desirable to use the remote indicator in order to observe readings some distance from the location of the unit. When the remote indicator is used, it is connected by means of the 25-foot remote indicator cable which is attached to the main unit by inserting its plug connector into the "Recorder-External Meter" jack at the bottom left of the front panel.

c. Headset, EA-112. The headset is plugged into the "Phones" jack near the bottom center of the front panel.

d. Tripod, TP-112. If radiated measurements are to be made, the tripod is employed as the mounting base for either the Broadband Directional Antenna, Model AT-112, or the Broadband Omni-Directional Antenna, Model BB-112. Extend the legs to the desired height and tighten the leg locking screws securely.

e. Broadband Directional Antenna, AT-112. When quantitative radiated measurements are to be performed, mount the 18" parabolic reflector on to the tripod. Normally, the pyramidal log-periodic feed is utilized; the other end of the RF cable attached to the type "N" female connector on this feed is connected to the "Signal Input" connector on the main unit, BA-112. For the exceptional cases where highest possible gain is required above 6 KMC, the horn feed is substituted by loosening the four thumb screws.

f. Broadband Omni-Directional Antenna, BB-112. When spectrum surveillance is necessary, and the direction of possible signals not known, the broadband omni-directional antenna is mounted on to the tripod and connected by attaching an RF cable between its output connector and the "Signal Input" connector on the main unit.

## 2.2 Description of Operating Controls

a. "Signal Input Attenuator." This device, which has positions of 0, 20, 40, and 80 DB, is utilized to attenuate the incoming signal by discrete known amounts so as to obtain on-scale meter readings, once the "IF Gain" control setting is temporarily fixed. The Signal Input Attenuator is operated by a Pull-Turn-Push sequence.

b. "Read-Calibrate" Switch. This coaxial switch has two settings. Normally, it is left in the "Read" position, which channels to the tuning unit whatever signal is applied to the SIGNAL INPUT connector; when the instrument is to be calibrated by use of the built-in impulse generator, this switch is set to the "Calibrate" position, which connects the impulse generator to the tuning unit.

c. "Bandwidth" Switch. This switch is set to either the "Wide" or "Narrow" position, depending on whether the broad system bandwidth or the narrow system bandwidth, which is approximately one-fifth of the broad, is desired.

d. Function Switch. This switch has 4 positions:

1. The "CW Average" position is utilized to obtain the RMS value of a CW signal.

2. The "CW Peak" position is utilized to measure modulated CW. Readings obtained on unmodulated CW are .707 of the peak value (RMS); readings obtained on modulated CW are .707 of the peak value of the modulated wave. Thus, the difference in readings obtained on the "CW Average" and "CW Peak" positions permits measurement of modulation index.

3. The "Pulse Peak" position is used for measurement of either pulsed CW or broadband noise; this position is also used whenever the Impulse Generator is turned on for calibration. Readings obtained in this position represent the true peak value of pulses, either signal or noise.

4. The "Zero Adjust" position is used in conjunction with the adjacent knob to zero the panel meter (upper right corner) prior to use for a series of measurements utilizing the "Pulse Peak" function.

e. Impulse Generator Controls. The Impulse Generator is turned on by setting the 2-position switch, located to the upper right of the Impulse Generator level control, to the "ON" position. The device is normally left "OFF", being turned "ON" only when calibration is indicated. The I.G. level control consists of an 11-step attenuator which varies the I.G. output in 1 DB increments. The dial for this switch is calibrated in DB above 1 uv per megacycle, which is the unit of measurement appropriate to broadband noise. The "Contact Adjust" is a screwdriver adjustment, the infrequent use of which is covered in a footnote in Section III - Operation.

f. "Slideback". This control varies the bias of a slideback detector and is employed for aural slideback measurements as described in Section III - Operation.

g. IF "Gain". This control varies the gain of the system by adjusting bias on several 60 MC IF stages.

h. "Volume". This control is used to adjust for adequate volume when a headset is plugged into the "Phones" jack.

i. "Power" Control and Indicators. The "Power" control switch has three positions: "Off", "Standby", and "On". In the "Off" position, the AC input voltage is not connected to any circuits beyond this switch. In the "Standby" position, all voltages in the entire instrument are applied and active, except for the Klystron beam. When the switch is placed in the "On" position, this voltage is also applied, except that a time delay relay insures a delay before the beam voltage is applied to make the klystron fully active. However, if the "Power" switch has been in the "Standby" position for 45 seconds or more before being switched to "On", no additional delay is incurred.

j. Tuning Unit Controls. The basic operation of the main tuning dial is obvious; this single knob simultaneously adjusts all variables in the tuning unit so as to insure optimum performance at any frequency to which the dial is set. An "AFC On-Off" switch functions to activate or de-activate automatic control of the klystron frequency which permits "locking" on to an incoming signal.

## PART TWO - OPERATING INSTRUCTIONS

## SECTION III

## OPERATION

### 3.1 Applications and Methods of Measurement

There are two basic parameters which can be measured with the Model NF-112. The first is RF voltage; in this mode of operation the instrument measures various waveforms of two-terminal RF voltage applied to its SIGNAL INPUT connector, and the antenna is not utilized. The second mode of operation involves use of the antenna; in this case, the instrument yields a measure of the field strength of a variety of RF signal types. Paragraphs 3.2 through 3.4.2, below cover the various "two-terminal" measurements, while paragraphs 3.5 through 3.5.3 cover applications of the instrument for "radiated" measurements, using the antenna. In either case, however, the instructions which follow relative to initial adjustments must be followed.

### 3.2 Control Settings

Before actual operation of the instrument, set the controls to the following respective positions:

| CONTROL | POSITION |
|---|---|
| FUNCTION SWITCH | ZERO ADJ. |
| BANDWIDTH | WIDE |
| READ-CALIBRATE | CALIBRATE |
| POWER | OFF |
| SIGNAL INPUT ATTENUATOR | 20 DB |

NOTE: The SIGNAL INPUT ATTENUATOR control knob must be pulled out before being turned. Upon lining up the dot with the desired position, push the knob all the way in.

| | |
|---|---|
| IMPULSE GEN. | OFF |

### 3.3 Initial Adjustment

a. Insure that the Tuning Unit installed is that appropriate to the frequency range to be measured. Connect the signal to be measured through the input cable to the SIGNAL INPUT connector on the front panel of the instrument.

NOTE: When setting a Tuning Unit on a bench, keep the front panel away from the edge of the bench. The RF gasket on the back plate of the front panel can be damaged if the panel "lip" is pressed against the edge of a bench.

b. Turn the POWER switch to STANDBY and allow the equipment to warm up for a few minutes. Turn the POWER switch to ON and watch for the KLYSTRON pilot light (amber) to light.

c. Adjust the ZERO ADJ. control so that the panel meter reads zero.

## 3.4 Two-Terminal Measurements

This section covers measurement of the level and spectrum characteristics of unknown voltages as they appear at the SIGNAL INPUT connector on the front panel. Measurement of radiated signals, involving use of the antenna, is covered beginning in paragraph 3.5.

### 3.4.1 Direct Readings (Instrument Calibrated)

The majority of readings with the Model NF-112 are accomplished by first calibrating the instrument and reading the resulting voltage directly on the panel meter (taking into account the SIGNAL INPUT ATTENUATOR setting when appropriate). In paragraph 3.4.2, below, an aural slideback method is described; this is for use in the few exceptional cases where direct reading is not feasible.

#### 3.4.1.1 Calibration

a. With the READ-CALIBRATE switch in the CALIBRATE position, set the FUNCTION SWITCH to PULSE PEAK.

b. Turn the IMPULSE GENERATOR switch to ON and set the IMPULSE GENERATOR level control to maximum (53 DB).

c. Set the SIGNAL INPUT ATTENUATOR to the value indicated for the desired frequency. (See charts, Figures 3-1 through 3-4 following.)

d. Adjust the GAIN control for a meter reading corresponding to the same frequency. (Figures 3-1 through 3-4.)

Note 1 - In order to insure maximum useful life of the impulse generator contacts, always keep the impulse generator "OFF", except when in actual use.

Note 2 - The Impulse Generator CONTACT ADJ. control is factory-set to the proper position. However, it can be confirmed that the setting is proper: With the READ-CALIBRATE switch in the CALIBRATE position, turn the IMPULSE GENERATOR switch on and listen to the impulse generator tone with the earphones connected to the PHONES jack. Adjustment of the SIGNAL INPUT ATTENUATOR and/or GAIN control may be necessary for an audible tone. Turn the CONTACT ADJ. control fully clockwise; then, rotate it slowly counterclockwise until the clearest tone is heard.

CALIBRATION CHART FOR TUNING UNIT T-1/NF-112

SERIAL NO.

NOTE: (1) Calibrated in "WIDE" bandwidth position
(2) Set IG LEVEL switch to maximum (53 DB)

| Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: |
|---|---|---|
| 0.9 | | |
| 1.0 | | |
| 1.1 | | |
| 1.2 | | |
| 1.3 | | |
| 1.4 | | |
| 1.5 | | |
| 1.6 | | |
| 1.7 | | |
| 1.8 | | |
| 1.9 | | |
| 2.0 | | |
| 2.1 | | |

Figure 3-1

CALIBRATION CHART FOR TUNING UNIT T-2/NF-112

SERIAL NO.

NOTE: (1) Calibrated in "WIDE" bandwidth position
(2) Set IG LEVEL switch to maximum (53 DB)

| Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: | Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: |
|---|---|---|---|---|---|
| 2.0 | | | 3.1 | | |
| 2.1 | | | 3.2 | | |
| 2.2 | | | 3.3 | | |
| 2.3 | | | 3.4 | | |
| 2.4 | | | 3.5 | | |
| 2.5 | | | 3.6 | | |
| 2.6 | | | 3.7 | | |
| 2.7 | | | 3.8 | | |
| 2.8 | | | 3.9 | | |
| 2.9 | | | 4.0 | | |
| 3.0 | | | | | |

Figure 3-2

CALIBRATION CHART FOR TUNING UNIT T-3/NF-112

SERIAL NO.

NOTE: (1) Calibrated in "WIDE" bandwidth position
(2) Set IG LEVEL switch to maximum (53 DB)

| Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: | Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: |
|---|---|---|---|---|---|
| 3.9 | | | 5.6 | | |
| 4.0 | | | 5.7 | | |
| 4.1 | | | 5.8 | | |
| 4.2 | | | 5.9 | | |
| 4.3 | | | 6.0 | | |
| 4.4 | | | 6.1 | | |
| 4.5 | | | 6.2 | | |
| 4.6 | | | 6.3 | | |
| 4.7 | | | 6.4 | | |
| 4.8 | | | 6.5 | | |
| 4.9 | | | 6.6 | | |
| 5.0 | | | 6.7 | | |
| 5.1 | | | 6.8 | | |
| 5.2 | | | 6.9 | | |
| 5.3 | | | 7.0 | | |
| 5.4 | | | 7.1 | | |
| 5.5 | | | | | |

Figure 3-3

CALIBRATION CHART FOR TUNING UNIT T-4/NF-112

SERIAL NO.

NOTE: (1) Calibrated in "WIDE" bandwidth position
(2) Set IG LEVEL switch to maximum (53 DB)

| Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: | Freq. in KMC | Set DB SIGNAL INPUT ATTEN-UATOR to: | Set IF GAIN for Meter reading (in DB) of: |
|---|---|---|---|---|---|
| 7.0 | | | 8.6 | | |
| 7.1 | | | 8.7 | | |
| 7.2 | | | 8.8 | | |
| 7.3 | | | 8.9 | | |
| 7.4 | | | 9.0 | | |
| 7.5 | | | 9.1 | | |
| 7.6 | | | 9.2 | | |
| 7.7 | | | 9.3 | | |
| 7.8 | | | 9.4 | | |
| 7.9 | | | 9.5 | | |
| 8.0 | | | 9.6 | | |
| 8.1 | | | 9.7 | | |
| 8.2 | | | 9.8 | | |
| 8.3 | | | 9.9 | | |
| 8.4 | | | 10.0 | | |
| 8.5 | | | | | |

Figure 3-4

e. Turn the READ-CALIBRATE switch to READ and the IMPULSE GENERATOR switch to OFF. The instrument is now direct reading with full scale sensitivities shown below. Do not disturb the GAIN control position. If the signal level does not give a satisfactory on-scale reading, the SIGNAL INPUT ATTENUATOR setting can be changed, giving the full scale sensitivities as shown in the following chart:

| Signal Input Attenuator Setting | Full Scale Sensitivity |
|---|---|
| 0 DB | 100 uv = 40 DB above 1 uv |
| 20 DB | 1000 uv = 60 DB above 1 uv |
| 40 DB | 10,000 uv = 80 DB above 1 uv |
| 60 DB | 100,000 uv = 100 DB above 1 uv |
| 80 DB | 1 volt = 120 DB above 1 uv |

Note that the actual level in DB above 1 uv is the sum of the SIGNAL INPUT ATTENUATOR setting and the panel meter reading.

3.4.1.2 Measurement Procedure

The FUNCTION SWITCH should be left in the PULSE PEAK position unless the signals are of a CW or modulated CW nature. For CW signals, the CW AVERAGE position of the FUNCTION SWITCH should be utilized; if the CW is modulated and an indication of the level of the modulated wave form is desired, the FUNCTION SWITCH should be placed in the CW PEAK position.

Considerable information about the signal being monitored can be obtained by noting the NF-112 meter indication as the unit is tuned through the frequency of the signal; viewing the signal on an oscilloscope connected to the VIDEO OUTPUT connector can also yield pertinent data as to the character of the signal.

3.4.1.2 a. Measurement of CW or Modulated CW

Once the instrument is calibrated, and the GAIN control not disturbed, readings taken with the FUNCTION SWITCH in the "CW AVERAGE" position will yield the RMS value of a CW signal. Turning the FUNCTION SWITCH to the "CW PEAK" position will result in an identical reading for an unmodulated signal; however, if the CW signal is modulated, this position of the FUNCTION SWITCH will then give .707 of the peak value of the total waveform. Thus, these two FUNCTION SWITCH positions can be used to yield an accurate indication of the percentage of modulation.

3.4.1.2 b. Measurement of Pulse Signals or of Broadband Noise

Once the instrument is calibrated, and the GAIN control not disturbed, readings taken with the FUNCTION SWITCH in the "PULSE PEAK" position will be a function of pulse amplitude. When the input signal is of the broadband noise type, the meter reading produced is a function of the noise strength in terms of voltage per megacycle of bandwidth.

Taking care not to disturb the GAIN setting after calibration, once the SIGNAL INPUT ATTENUATOR is adjusted for an on-scale reading, meter sensitivity in DB above 1 microvolt is as follows:

| Signal Input Attenuator Setting | Full Scale Sensitivity |
|---|---|
| 0 DB | 100 uv = 40 DB above 1 uv |
| 20 DB | 1000 uv = 60 DB above 1 uv |
| 40 DB | 10,000 uv = 80 DB above 1 uv |
| 60 DB | 100,000 uv = 100 DB above 1 uv |
| 80 DB | 1 volt = 120 DB above 1 uv |

Note that the actual signal level is the sum of the SIGNAL INPUT ATTENUATOR setting and the panel meter reading.

For broadband noise when a reading in terms of DB above 1 microvolt per megacycle (DBMC) is desired, subtract DB from the reading in DB above 1 uv; this takes into account the impulse bandwidth of the instrument. The reading thus calculated is the actual DBMC of the broadband noise signal as it appears at the SIGNAL INPUT connector.

3.4.1.2 c. Bandwidth Switching

As mentioned at the beginning of this section, the wide-narrow BANDWIDTH switch is usually left in the WIDE position. However, there are several instances in which it might be desirable to use the NARROW position.

In the event that it has been established that the signal to be measured is of a narrow-band nature, it is possible to obtain increased signal-to-noise ratio by switching to the NARROW bandwidth position, since the amount of noise, both external and internally-generated, is reduced by narrowing the bandwidth. Obviously, however, if the signal has a spectrum wider than the narrow bandwidth of the instrument, then a portion of the desired signal will be lost by using the NARROW position.

In order to determine the width of the spectrum of an unknown signal, the bandwidth switch can sometimes be used to advantage. For a broadband noise signal with a uniform spectrum across the entire WIDE bandwidth of the NF-112, switching to the NARROW bandwidth will result in a 12 to 14 DB decrease in the PULSE PEAK indication. If the amount of decrease is less than that, it can be assumed that the signal spectrum is not uniformly distributed across the WIDE bandwidth and it must be considered a narrow band signal.

3.4.2 Aural Slideback Method

Although the Direct Reading, calibrated, method, covered above, will be used for the vast majority of measurements, in the event that the signal input consists of pulses at an extremely slow repetition rate, the following slideback method might prove more suitable.

Turning the Slideback control, located on the front panel, (right side) varies the bias which is applied to a separate slideback detector. This produces a clipping action, so that this detector passes only those signals which exceed the bias level; as a result, background noise is removed, allowing only the peaks of pulses to be heard. By increasing the slideback bias so that the peaks are barely audible, and by then matching this barely audible level with the calibrated output of the built-in Impulse Generator, it is possible to accomplish accurate measurement of pulses which are sporadic or which are occuring at very low repetition rates. To begin a slideback measurement, observe the following:

| Control | Position |
|---|---|
| SLIDEBACK | Mid-position |
| VOLUME | Maximum |
| IMPULSE GENERATOR | "Off" |
| READ-CALIBRATE | "Read" |
| FUNCTION SWITCH | "Pulse Peak" |
| BANDWIDTH | "Wide" |

a. The SIGNAL INPUT ATTENUATOR should be set at the highest level which will permit monitoring the unknown noise with the GAIN control not set near either extreme.

b. Tune the desired signal, readjusting the GAIN as necessary to facilitate the tuning process.

c. Adjust the SLIDEBACK control until the signal is just barely audible.

d. Turn the READ-CALIBRATE switch to "Calibrate" and the Impulse Generator to "ON".

e. Without disturbing the GAIN control, adjust the IMPULSE GENERATOR and the SIGNAL INPUT ATTENUATOR, if necessary, for the same threshold of audibility achieved on the unknown signal.

f. If the level of the unknown signal was higher than the maximum output of the impulse generator, making it necessary to reduce the insertion loss of the SIGNAL INPUT ATTENUATOR when applying the I.G. calibrating signal, the change in SIGNAL INPUT ATTENUATOR setting in DB must be added to the impulse generator setting in DBMC, to determine the unknown level. Conversely, if the level of the unknown signal is lower than the lowest output of the impulse generator, making it necessary to increase the insertion loss of the SIGNAL INPUT ATTENUATOR when applying the I.G. calibrating signal, the change in SIGNAL INPUT ATTENUATOR setting in DB must be subtracted from the impulse generator setting in DBMC.

## 3.5 Radiated Measurements

The only difference between the measurements covered by this section and those covered in paragraphs 3.1 through 3.4 above is that the antenna,

AT-112, is used and its characteristics taken into account. Thus, everything covered in these preceding paragaraphs is entirely applicable; the two-terminal voltage thus measured is now that which appears at the end of the antenna cable, which is attached to the SIGNAL INPUT connector. Conversion of this two-terminal voltage to field strength (voltage per meter) is obtained simply by adding a number of DB, termed the antenna factor.

Figure 3-5 is a graph showing the antenna factor in DB as a function of frequency for the antenna, AT-112, using the pyramidal log-periodic feed. All pertinent considerations are included in this single factor, including antenna gain, cable losses and conversion to open circuit voltage. Similarily, for the horn feed, which may be used where highest possible sensitivity above 6KMC is required, Figure 3-6 shows a graph of the antenna factor. It is important to note that the antenna factor differs for the two feed systems; significant errors would result from using the wrong factor.

### 3.5.1 Antenna Operation

When setting the equipment up for interference measurements, it should be so located that the antenna is fully illuminated by the signal. When using the equipment for field intensity measurements, a site should be chosen which is relatively free from trees, power and telephone lines, metal fences, buildings and other projections that might distort the field strength pattern. For the majority of radiated measurements, the single wide bandwidth pyramidal feed will provide adequate sensitivity with unequalled convenience of operation. It is only necessary to mount on the tripod the parabolic reflector with the pyramidal feed assembly, connect the 6 ft. cable to the NF-112 SIGNAL INPUT connector and to orient the antenna for maximum response. Note that the "dish", with its feed; can be rotated so as to coincide with the polarization of the incoming signal; also be utilizing the dial on the back of the dish, it is feasible to measure relative polarization angles quite accurately. These same procedures and suggestions are equally applicable to the antenna when the waveguide horn feed is utilized.

### 3.5.2 Use of Antenna Factor

To illustrate the use of the antenna factor to convert two-terminal voltages to field strength, suppose that the antenna, AT-112, (with pyramidal feed) is connected to the SIGNAL INPUT connector. Following the procedures outlined in paragraphs 3.1 through 3.4.1.2a, assume that a two-terminal reading of 40 DB above 1 uv (100 uv) has been obtained on a CW signal at a frequency of 5000 MC. Consultation of Figure 3-5 discloses the antenna factor at 5000 MC to be 23.6 DB; thus, to convert the two-terminal reading to field strength, we add 23.6 DB to 40 DB, obtaining 63.6 DB above a microvolt per meter.

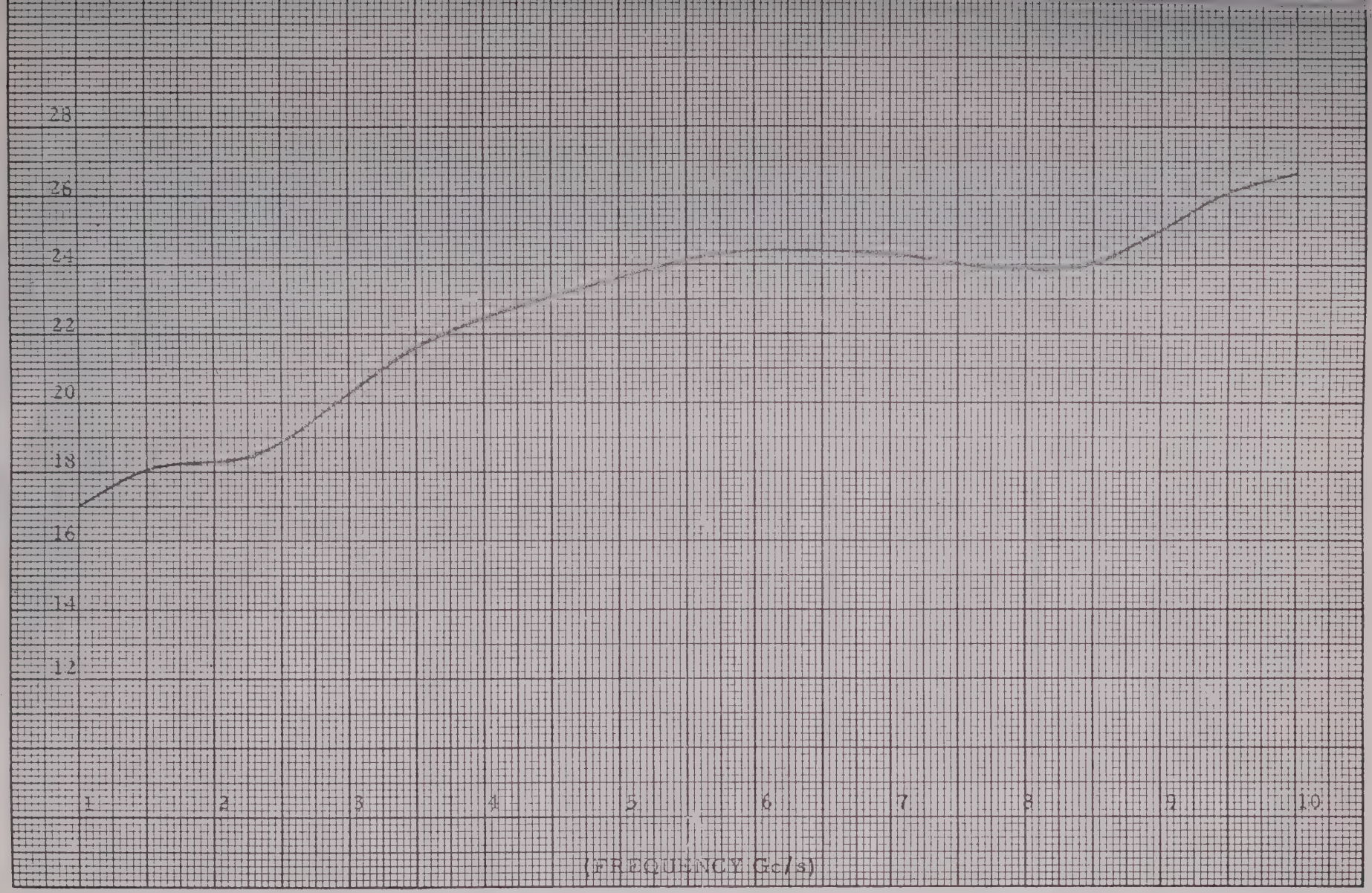



Figure 3-5. Antenna Factor - Pyramidal Feed with Cable

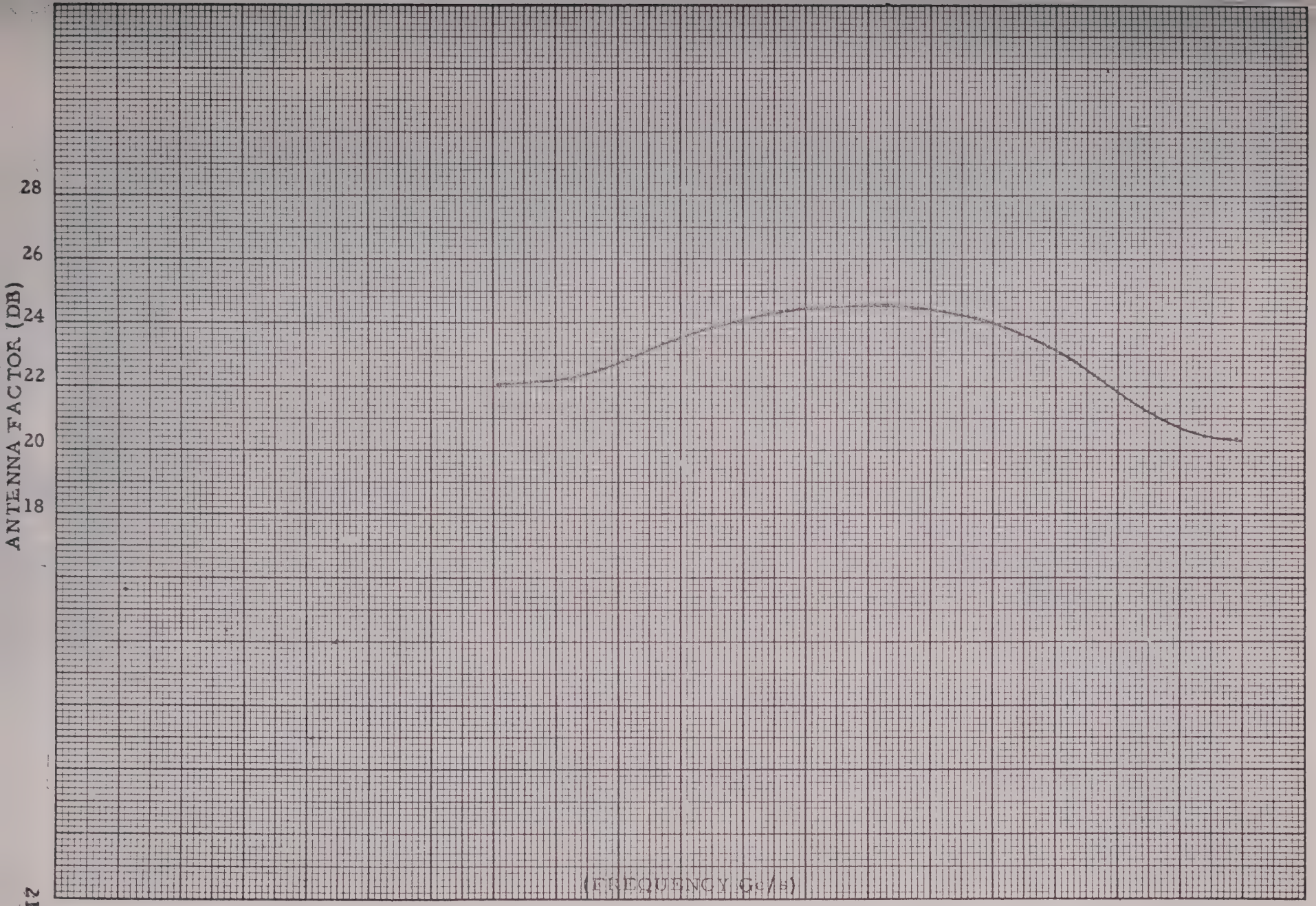



Figure 3-6. Antenna Factor - Horn Feed with Cable

### 3.5.3 Measurements in Accordance with Specification MIL-I-26600

Figures 7 and 9 of Specification MIL-I-26600 establish limits for radiated narrow band (CW) and radiated broadband and pulsed CW interference, respectively. However, Figures 7 and 9 specify the limits in terms of readings obtained with an antenna system with characteristics differing from those of the AT-112 system employed with the NF-112. Therefore, it is necessary to employ Figures 3-7 and 3-8, shown on the following 2 pages, in place of Figures 7 and 9, respectively, of MIL-I-26600. Simply read from Figure 3-7 or 3-8 the appropriate maximum limit of interference at the frequency under consideration and use it in place of the limit normally read on Figure 7 or Figure 9 of MIL-I-26600.

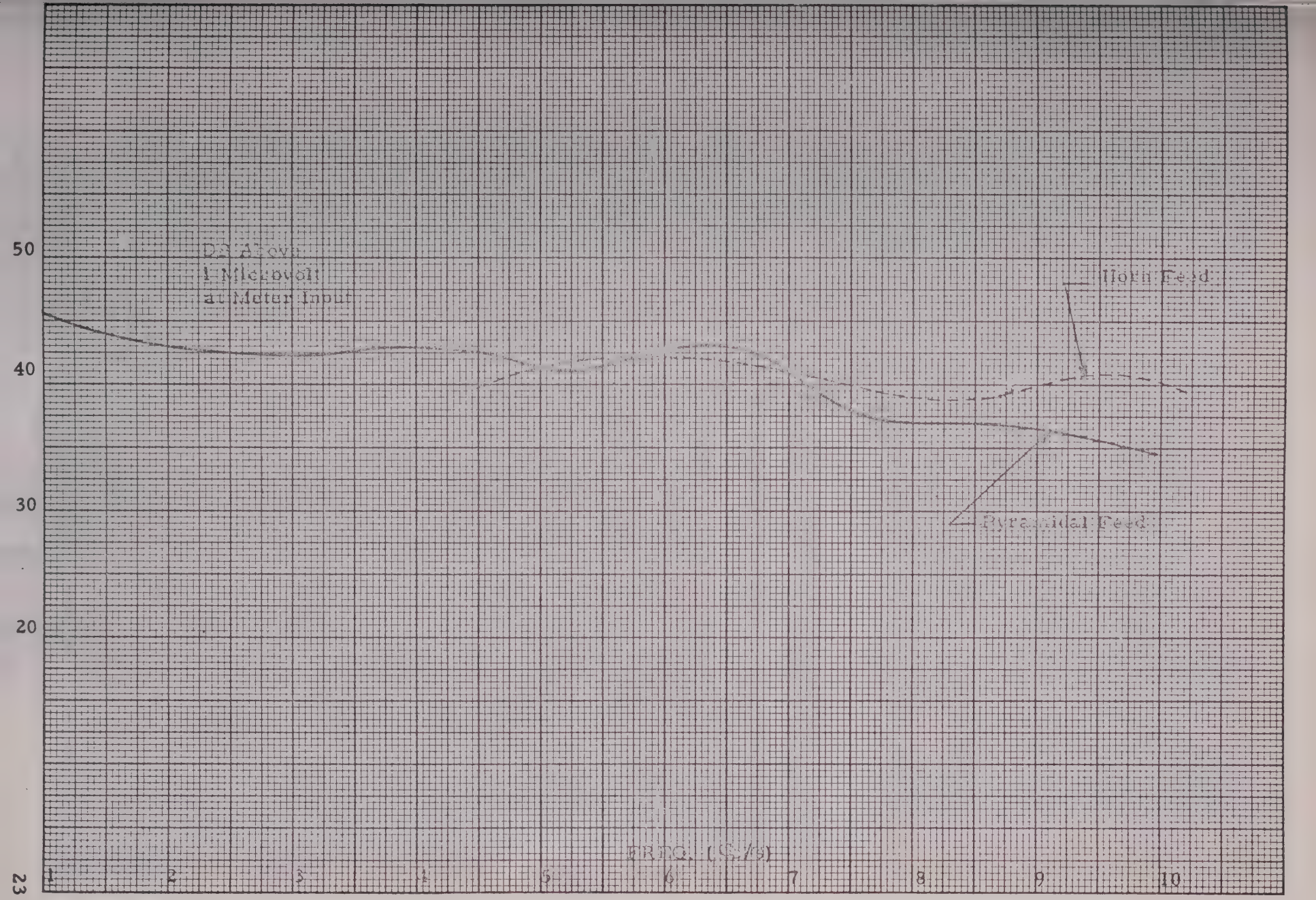
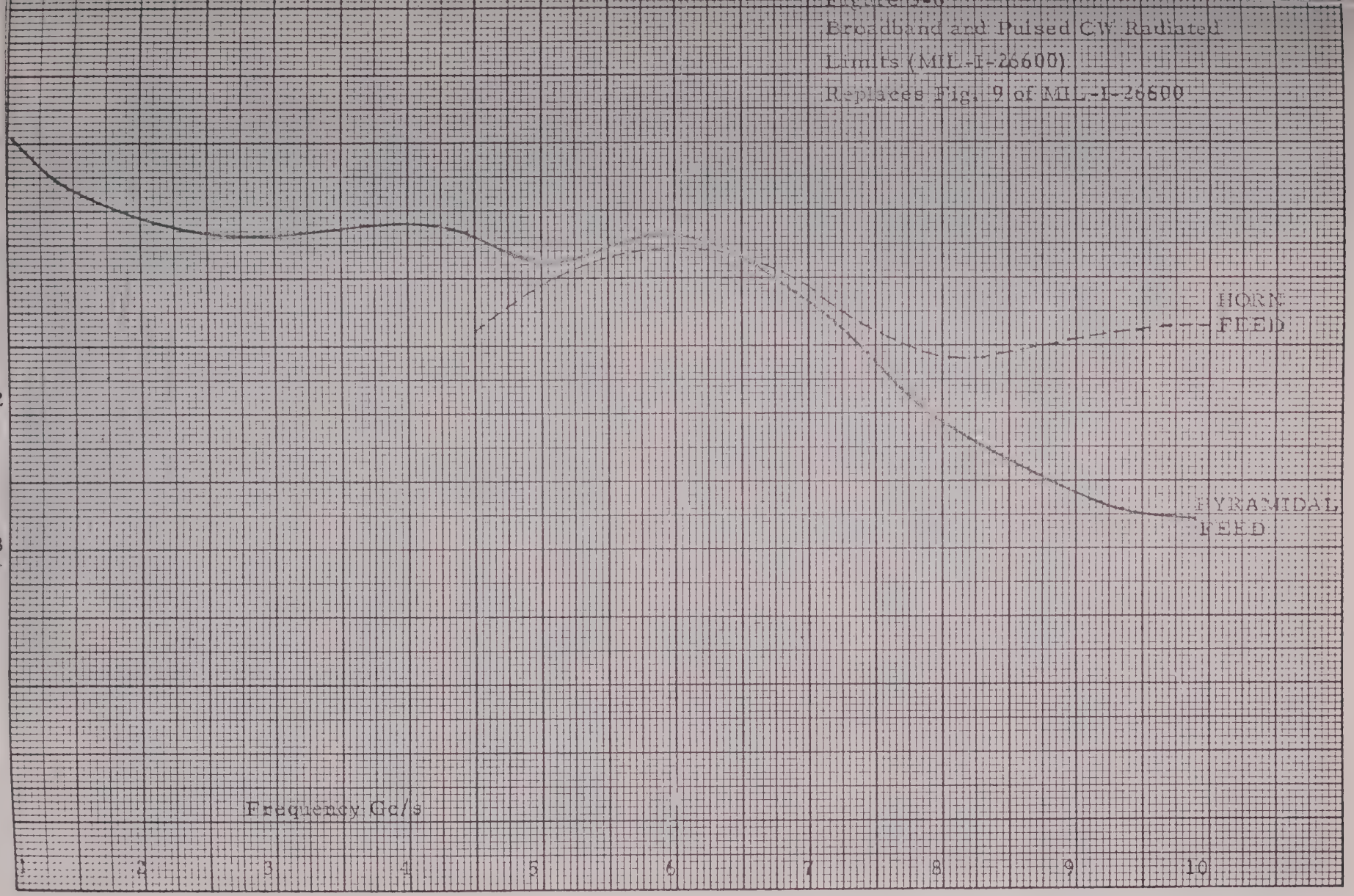



Figure 3-7. Narrow Band (CW) Radiated Limits (MIL-I -26600) (Replaces Fig. 7 of MIL-I-26600)

Broadband and Pulsed CW Radiated
Limits (MIL-I-26600)
Replaces Fig. 9 of MIL-I-26600



PART THREE - REPAIR INSTRUCTIONS

SECTION IV

THEORY OF OPERATION

## 4.0 Principle of Operation - General

Noise and Field Intensity Meter Model NF-112 is designed for measuring RF field intensity and RF interference over the frequency range from 1 KMC to 15 KMC. It is a sensitive broadband microwave triple superheterodyne receiver with internal calibration and metering circuits.

The equipment consists of a basic measuring unit and five individual tuning units. The basic measuring unit contains the signal input attenuator, IF circuits, detectors, video and audio circuits, the impulse generator, metering circuits, filters, audio and the power supply. The five tuning units, containing all RF circuits, are similar except for frequency range. Figure 4-1 is a block diagram of the entire instrument. (Tuning Unit T-5 will be covered in a separate section.)

The RF signal is fed into the tuning unit through the Signal Input Attenuator which provides attenuation in steps of 0, 20, 40 or 60 DB. Since the step attenuator switching also inserts 20 DB attenuation in the IF circuits, in all settings except "0 DB", a total attenuation variation of 80 DB is available within the NF-112. (Obviously, external broadband microwave frequency attenuators such as the Empire Devices Models AT-150 or the AT-160, can be utilized to extend the dynamic range still further.)

In the tuning units, the signal is passed through a dual-cavity preselector, preceded in T-1 and T-2 by a low pass filter. The signal and local oscillator voltage, which is generated by a klystron, heterodyne in a crystal mixer mounted on the preselector, to produce a 348 MC IF signal. This signal is fed through a matching network to the basic measuring unit. The local oscillator frequency is 348 MC higher than the signal in Tuning Units T-1 and T-2 and one-half the frequency which is 348 MC higher than the signal in Tuning Units T-3 and T-4.

Two precision potentiometers are tracked to provede the proper repeller voltage for the klystron, as well as a constant supply voltage for the AFC-DC amplifier. The potentiometers are mechanically ganged to the klystron cavity, preselector cavities, and a calibrated dial.

The 348 MC IF signal from the tuning unit is amplified by the 348 MC pre-amplifier in the basic measuring unit and fed to a second crystal mixer, where it is mixed with a 408 MC L.O. voltage generated by a 51 MC crystal-controlled local oscillator and three frequency doubler stages.

The resultant 60 MC output of the crystal mixer is amplified and then attenuated by 0 or 20 DB, depending on the particular Signal Input Attenuator position selected. After further amplification, it is fed to a third mixer where it is mixed with a 102 MC local oscillator signal to produce a

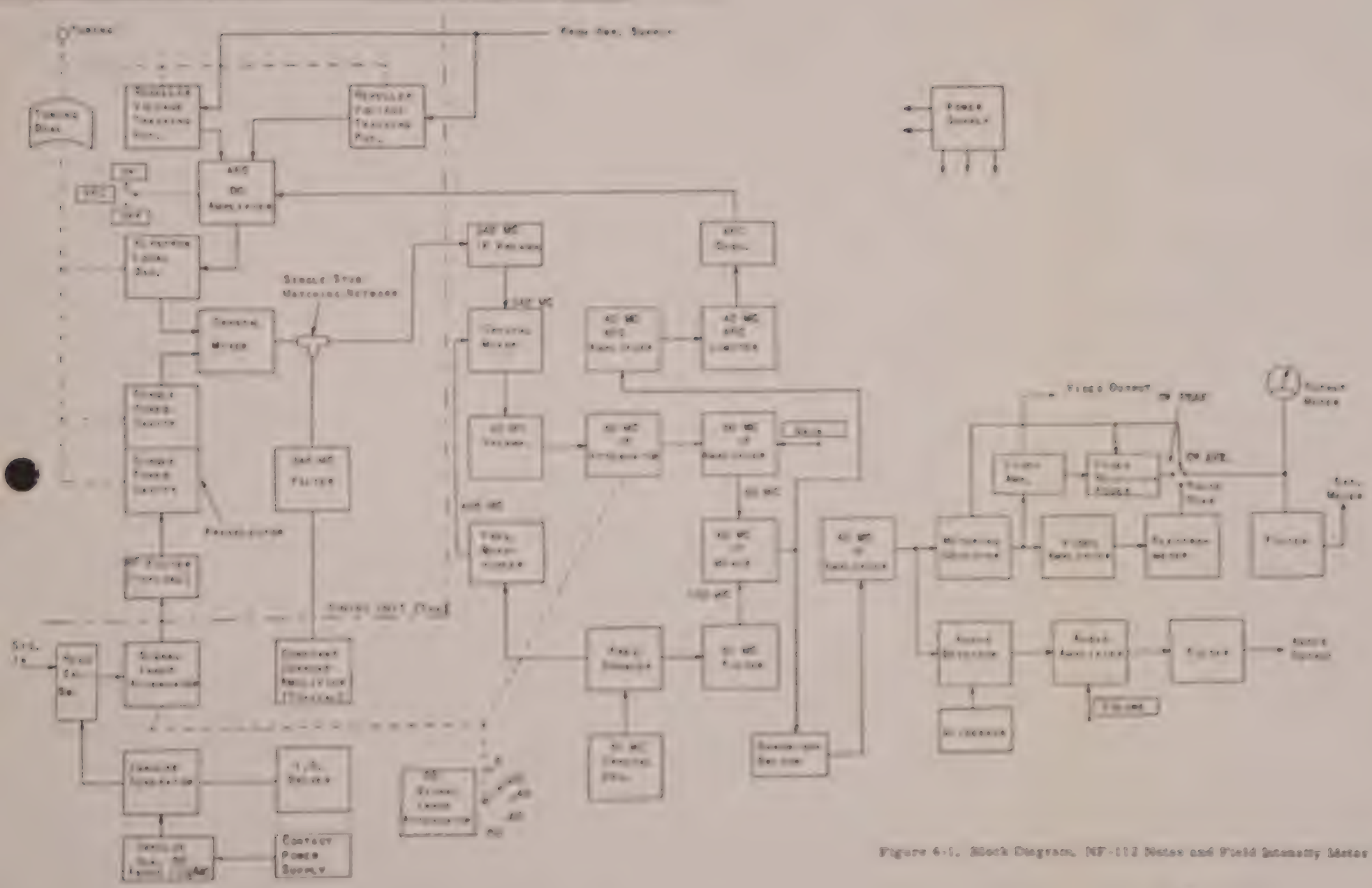
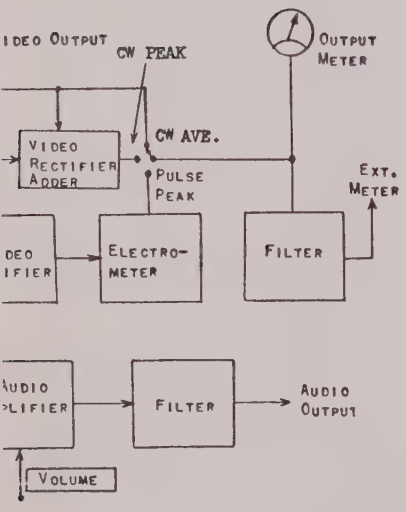


Figure 4-1. Block Diagram, NF-112 Notes and Field Intensity Meter




NF-112 Noise and Field Intensity Meter

final IF frequency of 42 MC. This IF signal is then amplified and fed to the audio and video detectors.

The output of the audio detector is volume-controlled, amplified and then connected through a filter to the "phone" jack. The audio detector is also utilized for aural peak value measurements in conjunction with the SLIDEBACK control, which varies its bias.

The output of the metering detector is fed to one of three different circuits, depending on the setting of the function switch.

a. In the CW AVERAGE position, it is fed directly to the meter.

b. In the CW PEAK position, the detected signal goes both directly to an adding network and, through a cathode follower, video amplifier and a detector, back to the adding network, from where it is sent to the meter.

c. In the PULSE PEAK position, the detected signal is fed through a cathode follower, video amplifier and electrometer, into a second cathode follower, the output of which is fed to the meter. The video signal is also amplified and then fed to the video connector on the front panel.

The power supply furnishes, in addition to several sources of unregulated 6.3 volts AC voltage, the following regulated DC voltages:

| | |
|---|---|
| -150 volts | -325 volts |
| +150 volts | -975 volts |
| +6.3 volts | +1.2 volts |

An impulse generator serves as the calibrator, permitting speedy and accurate calibration of the instrument. This device produces extremely short pulses whose spectrum is uniformly distributed over the frequency range. The pulses are generated by discharging a short length of charged coaxial line into a load impedance, through a mechanically vibrating contact.

An AFC-IF amplifier, limiter and discriminator furnish a correction voltage to the DC amplifier in the tuning unit, permitting easier narrow-band tuning and the ability to "hold" a signal.

## 4.1 Discussion of RF Tuning Units

Figure 4-2 is a diagram representative of RF tuning units T-1 - T-4. In order to facilitate discussion and to show components in proper context, several components actually located in the main unit are included; this section is at the left side of the diagram.

Both the signal and the coaxial output of the impulse generator are fed to the coaxial READ-CALIBRATE switch. In the "READ" position, the signal then goes through the coaxial Signal Input Attenuator which subjects it to 0, 20, 40 or 60 DB of attenuation, independent of its RF frequency.

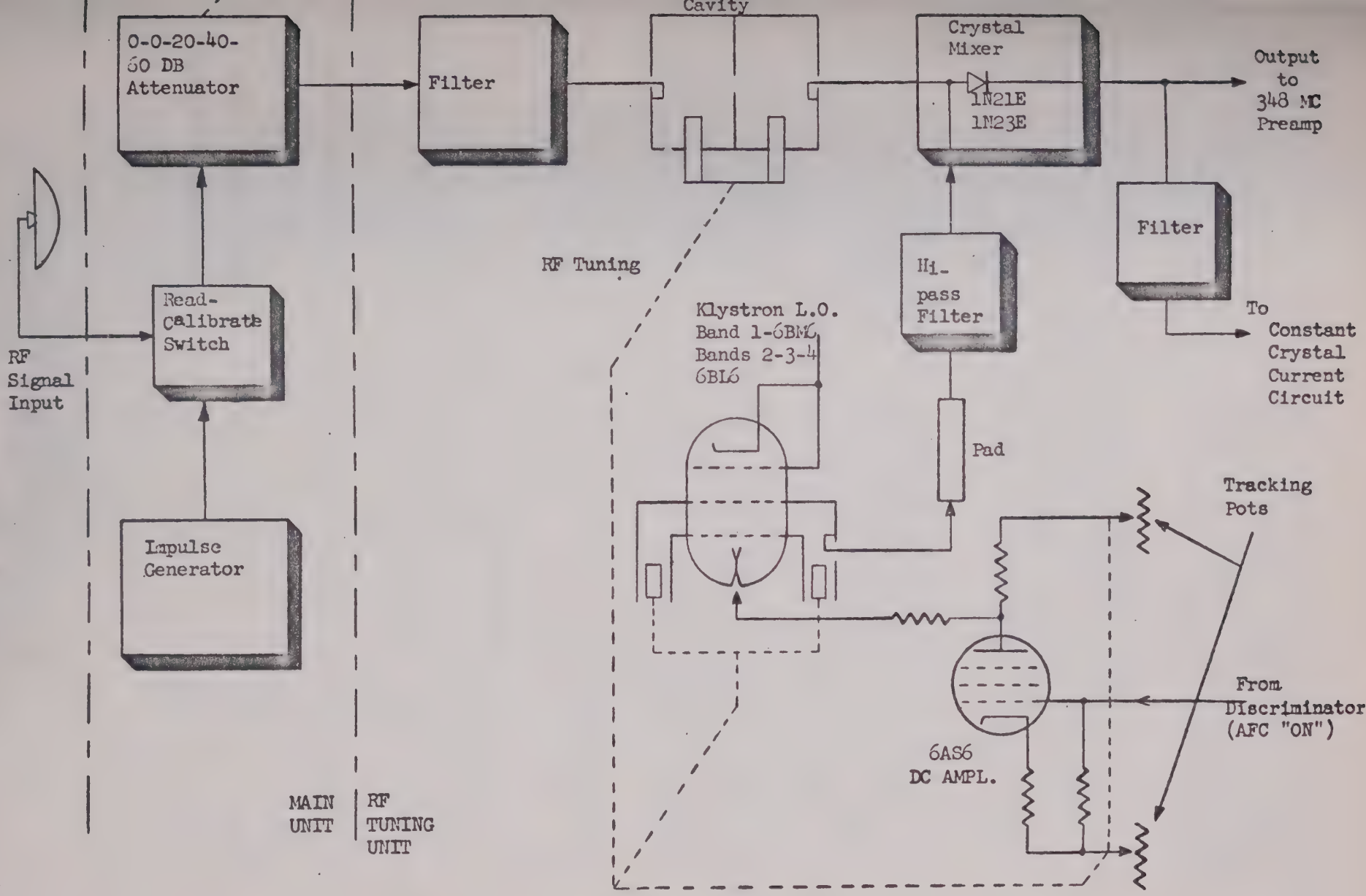



Figure4-2- RF Tuning Unit

The setting of this attenuator is mechanically linked to that of the attenuator in the 60 MC IF signal path. When a total attenuation of only 20 DB is desired, the RF attenuation is 0 DB and the IF 20 DB, so as to avoid deterioration of the signal-to-noise ratio for this relatively weak signal; for higher total signal attenuation, both RF and IF attenuation are employed, up to a total of 80 DB, to permit handling of signal as large as 1 volt, without external attenuators.

From the RF attenuator the signal then passes through a filter (in Tuning Units T-1 and T-2), which rejects multiples of the desired frequency, to the dual-cavity pre-selector, which is tuned to the appropriate RF frequency through mechanical adjustment of the length of two resonant coaxial open lines. This dual cavity affords rejection of unwanted signals. The signal is then coupled from the second cavity to the crystal mixer, which employs a 1N21E type silicon diode for RF bands 1, 2 and 3, and a 1N23E for band 4.

Also coupled to the mixer element is the output of the klystron local oscillator, whose tuning is ganged to the RF tuning so as to produce an IF of 348 MC. On bands 1 and 2, the local oscillator is tuned to be always 348 MC above the incoming RF signal. On bands 3 and 4, harmonic mixing is employed, with the local oscillator tuned at one-half that frequency which is 348 MC above the incoming signal frequency. The local oscillator employs a reflex klystron tube with an external coaxial cavity resonator whose tuning is adjusted by a short-circuiting plunger of a non-contacting design which prevents noise during tuning. This plunger is linked by means of the mechanical drive system to the two tracking potentiometers which vary the reflector to cathode voltage of the reflex klystron through a DC amplifier. The klystron resonator is grounded and the cathode operates at a negative potential. The L.O. signal is taken from the cavity resonator by means of a probe, and fed to the crystal mixer through an isolating pad.

The chart below shows the frequency ranges of the klystrons and the klystron and preselector modes employed in the various tuning units. Mode switching is not used.

| | Tuning Unit | | | |
|---|---|---|---|---|
| | #1 | #2 | #3 | #4 |
| Pre-Selector Range (MC.) | 850 - 2100 | 2000 - 4000 | 3900 - 7100 | 7000 - 10,200 |
| Pre-Selector Mode | $\frac{\lambda}{4}$ | $\frac{\lambda}{4}$ | $3\frac{\lambda}{4}$ | $3\frac{\lambda}{4}$ |
| Klystron Range (MC.) | 1198 - 2448 | 2348 - 4348 | 2124 - 3724 | 3674 - 5274 |
| Klystron Tube Type | 6BM6 | 6BL6 | 6BL6 | 6BL6 |
| Klystron Transit Mode | 2 3/4 | 2 3/4 | 2 3/4 | 3 3/4 |
| Klystron Cavity Mode | $\frac{\lambda}{4}$ | $3\frac{\lambda}{4}$ | $3\frac{\lambda}{4}$ | $3\frac{\lambda}{4}$ |

The 348 MC IF output of the mixer is fed through a one-half wavelength (at 348 MC) coaxial cable to the 348 MC planar triode preamplifier in the main unit. Along this connecting path, a T-connector is employed to return the direct current output of the crystal to ground through a bias circuit. In Tuning Unit T-4 and part of the range of the Tuning Unit T-3, a variable resistor is adjusted to that value which yields optimum sensitivity over the tuning range. In Tuning Units T-1 and T-2, and in part of the range of T-3, a transistor constant current circuit varies the bias automatically. This operates to maintain more nearly constant the residual noise output, as the tuning unit frequency range is scanned.

### 4.1.1 AFC

As noted above, the reflector voltage of the klystron local oscillator is supplied from a DC amplifier. Reference to figure 4-2 will show the basic configuration utilized. As the tuning unit frequency is varied, the tracking pots, which are ganged to the tuning mechanism, operate to keep the supply voltage across the 6AS6 DC amplifier essentially constant, while varying both ends of this supply relative to ground. Thus, the plate voltage output of the DC amplifier varies relative to ground to provide the reflector voltage appropriate to the frequency at which the klystron is to oscillate.

However, the input to the DC amplifier can be either shorted or connected to the output of the discriminator in the main unit, depending on whether the "AFC ON-OFF" switch connected to the DC amplifier grid is open (AFC "ON") or closed (AFC "OFF"). In the AFC "ON" position, the output of the discriminator is of the proper polarity to swing the DC amplifier plate-klystron reflector voltage in that direction which alters the L.O. frequency so as to restore the IF to 348 MC.

### 4.1.2 Mechanical Tuning System

This tuning system links the tuning of the preselector, klystron local oscillator, reflector voltage tracking potentiometers and the linear indicating dial together so that all are simultaneously controlled by the tuning control. The tuning control is coupled directly to a worm and driver gear combination. The driver gear drives a gear train which controls the movement of the dial and in turn is coupled by means of a fiberglass shaft to a second gear train which controls the tracking potentiometers. The worm or screw is stationary and is coupled by a nut having two extending arms, to a carriage on each side of the tuning unit. As the screw turns, the nut and arm combination moves down half the length of the screw, driving the two carriages in front of it. Each carriage carries an adjustable ramp. Both of these ramps are followed by a boomerang shaped follower which pivots and drives the pistons of the klystron and preselector cavities maintaining a proper tracking relationship.

## 4.2 Discussion of Main Unit, BA-112

In this section, the function of each of the chassis and major components which comprise the main unit will be covered. Frequent reference

to the system block diagram, Figure 4-1, will be useful in fitting the specific functions discussed into the overall system context.

### 4.2.1 348 MC Amplifier

This is the chassis mounted on "stilts" on the hinged top plate. Its function is to amplify the relatively weak signal fed to it from the mixer, up to a level sufficiently strong as to survive the next heterodyning (down to 60 MC) without significant noise figure deterioriation. The 348 MC amplifier itself is a very low-noise device so that it adds as little noise as possible to the relatively weak signal it is amplifying.

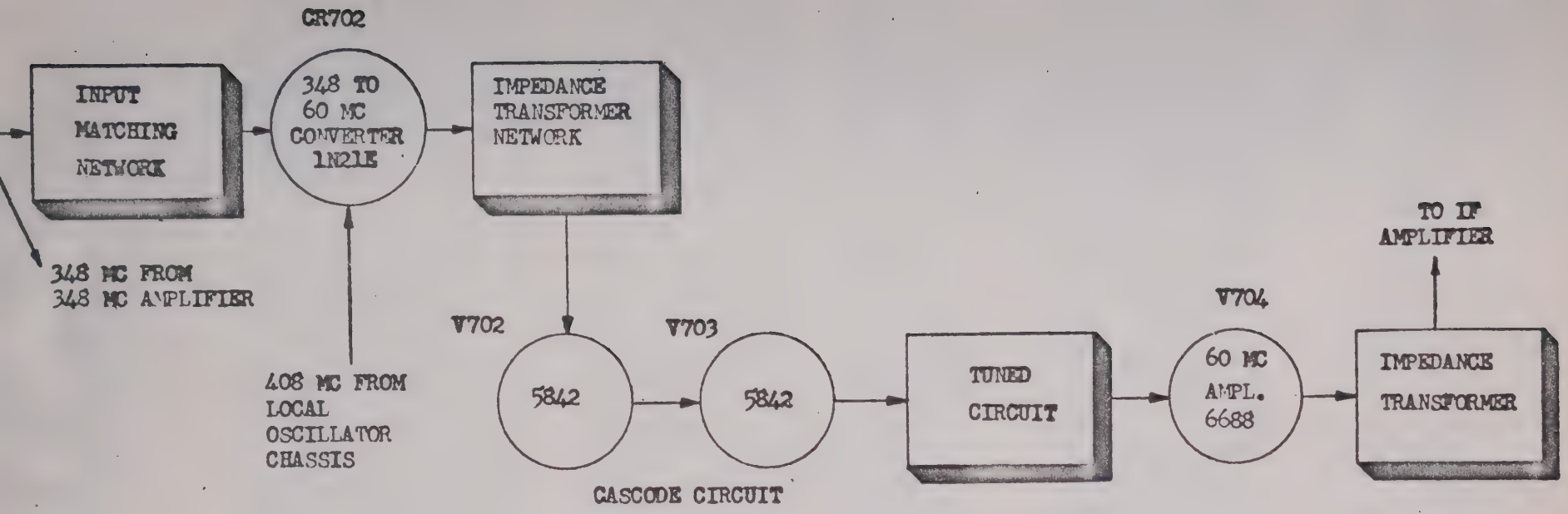
In order to fulfill this low-noise requirement, a ceramic planar triode, type 6299, is utilized in a grounded-grid configuration. Because of the relatively high operating frequency, 348 MC, it is convenient to employ distributed-constant circuitry, with both the input and output tuning elements consisting of inductive lengths of coaxial line which "tune" the capacitance which appears at the tube input and output, respectively.

Input and output coupling to these resonant circuits is by means of inductive loops. In the input circuit, the impedance transformation is such as to yield lowest noise figure while coupling the input energy to the low input impedance of the tube (which is roughly 1/gm for a grounded-grid amplifier). In the output circuit, the loop transforms the relatively high impedance of the plate circuit so as to couple effectively, with adequate bandwidth, into the coaxial cable which transfers it to the next chassis, the 60 MC preamplifier.

### 4.2.2 60 MC Preamplifier

A block diagram of this chassis which is located on the lower left corner of the hinged plate, is shown in Figure 4-3. The 348 MC input signal to this chassis is coupled to a 1N21E crystal mixer, through L701 which serves to form a broadly resonant series-tuned coupling circuit to the crystal input. Also coupled to the crystal, through 1 pf capacitor C908, is a 408 MC signal from the local oscillator chassis (located at the left side of the hinged top plate). The resulting 60 MC heterodyne output of the mixer is then coupled by an impedance-transformation network (C907 and L702) to a low-noise cascode amplifier. Test point TP705 is provided to permit monitoring of crystal current by measuring the voltage developed across 100-ohm resistor R850; L710 and C903 serve to block and filter the 60 MC signal.

The cascode circuit consists of a 5842 connected as a grounded-cathode amplifier, loaded by a 5842 connected as a grounded-grid amplifier. The heavy load imposed on the first tube by the second avoids the need for neutralization, while the high gain of the second tube connected in the inherently-stable grounded-grid arrangement preserves a low noise figure and affords a net overall gain comparable to that obtainable from a single high-gain pentode.




60 MC PREAMPLIFIER
FIGURE 4-3

A tuned circuit at the output of the second triode couples the signal to a high-gain 6688 pentode. L705, in conjunction with coupling capacitor C717, functions as an impedance transformation network to couple the 60 MC signal from the high impedance plate circuit to the coaxial line, which connects externally to output connector J706 to transfer it to the IF attenuator.

### 4.2.3 IF Attenuator

The IF Attenuator consists of a double resistive T-pad whose elements are connected to switch S707 to afford an attenuation difference of 20 DB between "ON" and "OFF" positions. Switch S707 is mounted in a shielded can on the rear of the coaxial Signal Input Attenuator; it is ganged to the Pull-Turn-Push-mechanism so as to insert 0 DB IF attenuation for a front panel setting of 0 DB and an IF attenuation of 20 DB for the other panel settings: 20 DB, 40 DB, 60 DB, and 80 DB. Reference to the main unit schematic, which shows the IF attenuator near the lower left-hand corner, readily illustrates the operation of this circuit.

### 4.2.4 60 MC IF Amplifier

After passing through the IF attenuator, the 60 MC signal enters J707 of the 60 MC IF Amplifier, a basic block diagram of which appears as Figure 4-4. This chassis is located at the right-center of the top hinged plate. A series-resonant network consisting of L711 and the total capacitance at the 6AK5 input grid (as loaded by R712) serves to transform the lower impedance of the coaxial cable up to the higher impedance of the grid.

Then follow 5 stages to 60 MC amplification, V705-V709, the first three of which are gain-controlled by a variable negative bias applied through RC filter networks to their grids. The value of this bias is controlled by the front panel IF gain control. After two additional stages of 60 MC amplification, the signal is coupled to the grid of V710. To the cathode of this tube is fed the 102 MC output of the local oscillator chassis. The output of V710, which is the difference between these two inputs, or 42 MC, is transformed downward in impedance and fed to both J709 and J750.

### 4.2.5 Bandwidth Switch Chassis (See Figure 4-5)

This chassis is mounted on the right side of the main unit. From the 60 MC IF amplifier chassis, the 42 MC output of the mixer is transferred through coaxial cable to a 6 DB isolation pad, and then to the center arm of one section of S703, the BANDWIDTH switch. The purpose of the 6 DB pad, consisting of R743, R825, and R875, is to prevent the mixer stage and impedance transformation network at the output of the 60 MC IF amplifier chassis from being detuned as S703 is switched from "WIDE" to "NARROW". In the "WIDE" position, S703 couples the 42 MC signal through a 3 DB pad, consisting of R835, R892, and R834, and then through coaxial cable to the 42 MC IF amplifier.

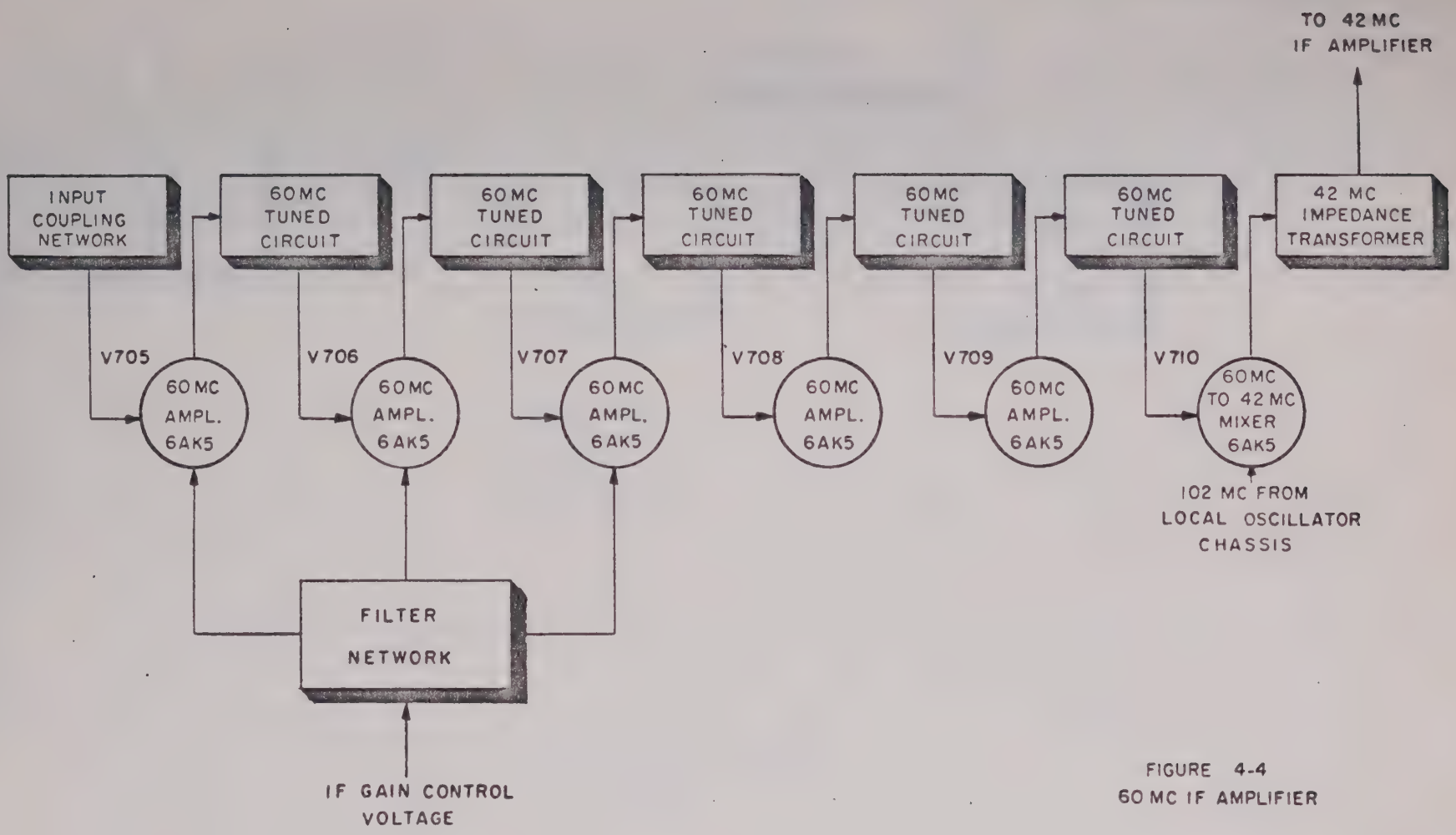
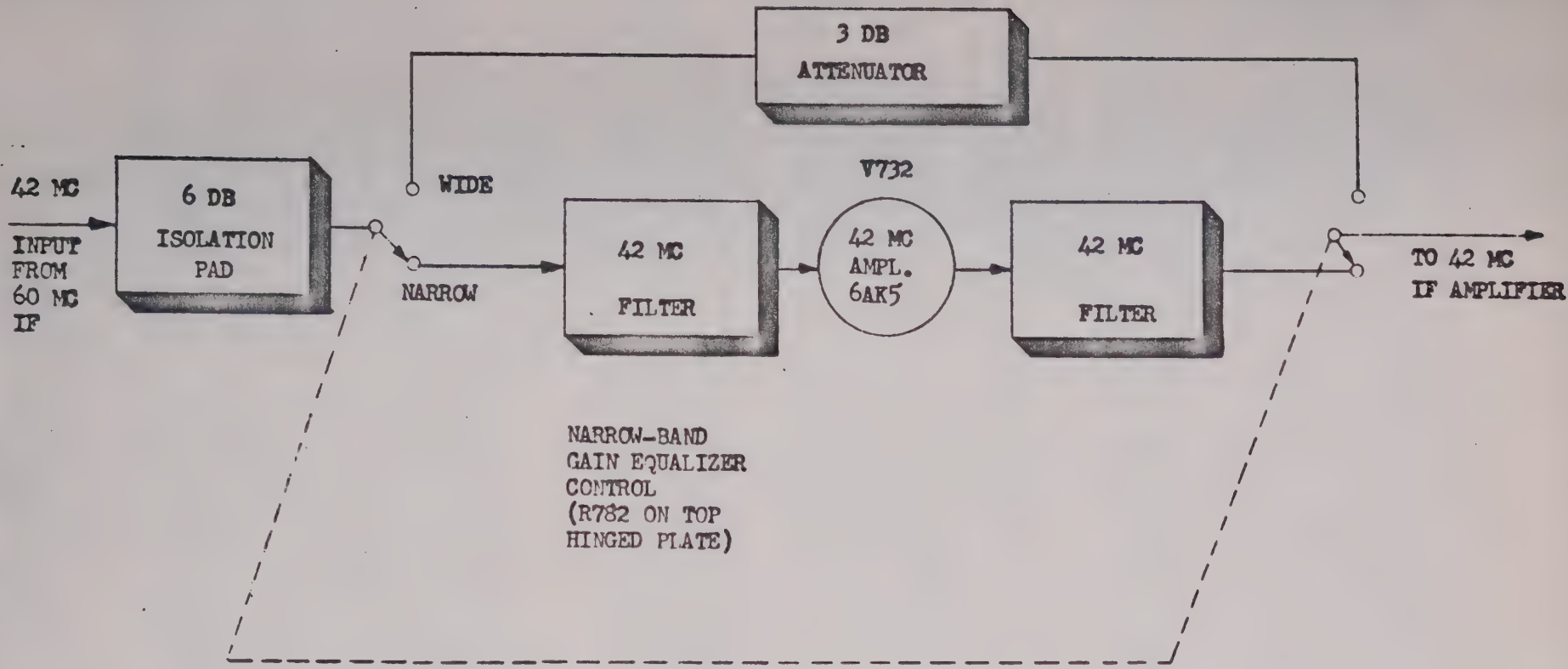



FIGURE 4-4
60 MC IF AMPLIFIER




BANDWIDTH SWITCH CHASSIS
FIGURE 4-5

In the "Narrow" position, the 42 MC signal is fed to an LC network which is sharply-tuned to transform the low-impedance signal up to the high-impedance grid. The narrowness of this filter can be adjusted by altering the relative values of variable capacitor C933 and variable inductance L759 while maintaining their resonance at 42 MC. The output of this filter is connected to the grid of V732, along with a negative bias; this bias is adjusted by means of R782, located on the top hinged plate of the main unit, to provide adjustment for equal gain for a CW signal in "WIDE" and "NARROW" BANDWIDTH switch positions.

The output of the amplifier stage is then coupled through another 42 MC filter, which serves both to narrow the bandwidth further and to transform the signal down to lower impedance for transfer through coaxial cable to the 42 MC IF amplifier chassis.

### 4.2.6 42 MC IF Amplifier

A block diagram of this chassis, which is located at the right side of the top hinged plate, is shown in Figure 4-6.

An input coupling network is used to transform the 42 MC signal from 50-ohm coaxial cable impedance up to the grid of V714, the first of five 42 MC 6AK5 amplifier stages. All five stages V714-718 are conventional and synchronously tuned at 42 MC. The last of these drives another 42 MC stage; however, this one utilizes a 6CL6, in order to obtain the greater dynamic range with linearity which is necessary in the stage which drives the detector.

Actually, the two halves of a 6AL5 are used as separate detectors. The first half, used as the metering detector, is fed through an .001 mfd. capacitor C808 from the output tuned circuit of the 6CL6, and constitutes the principal load on this stage. The other half of the detector, which is more lightly coupled to the 6CL6 output through a 5 pf capacitor C809, serves as the audio-slideback detector.

#### 4.2.6.1 CW AVERAGE and CW PEAK

The switching arrangement, which is shown in simplified form in the block diagram, Figure 4-6, illustrates that in the CW AVERAGE position (1), the output of this detector is coupled through a resistive network and then fed directly to the output meter. In the CW PEAK position, (2), the AC component of the signal out of the metering detector is fed through a cathode follower (1/2 of V721) to a video amplifier (other half of V721). Outputs from both the cathode and plate of this stage are utilized; the cathode output is fed through coaxial cable to the front panel and made available as the VIDEO OUTPUT. The plate output is capacitively coupled (C837) to a silicon diode detector CR706; here, the AC component is rectified and voltage divided before being added to the CW AVERAGE component to produce the CW PEAK component. The rectifying and adding circuit constants are selected so that a 100%-modulated CW signal will produce 6 DB greater output on the CW PEAK position than it will on the CW AVERAGE position.

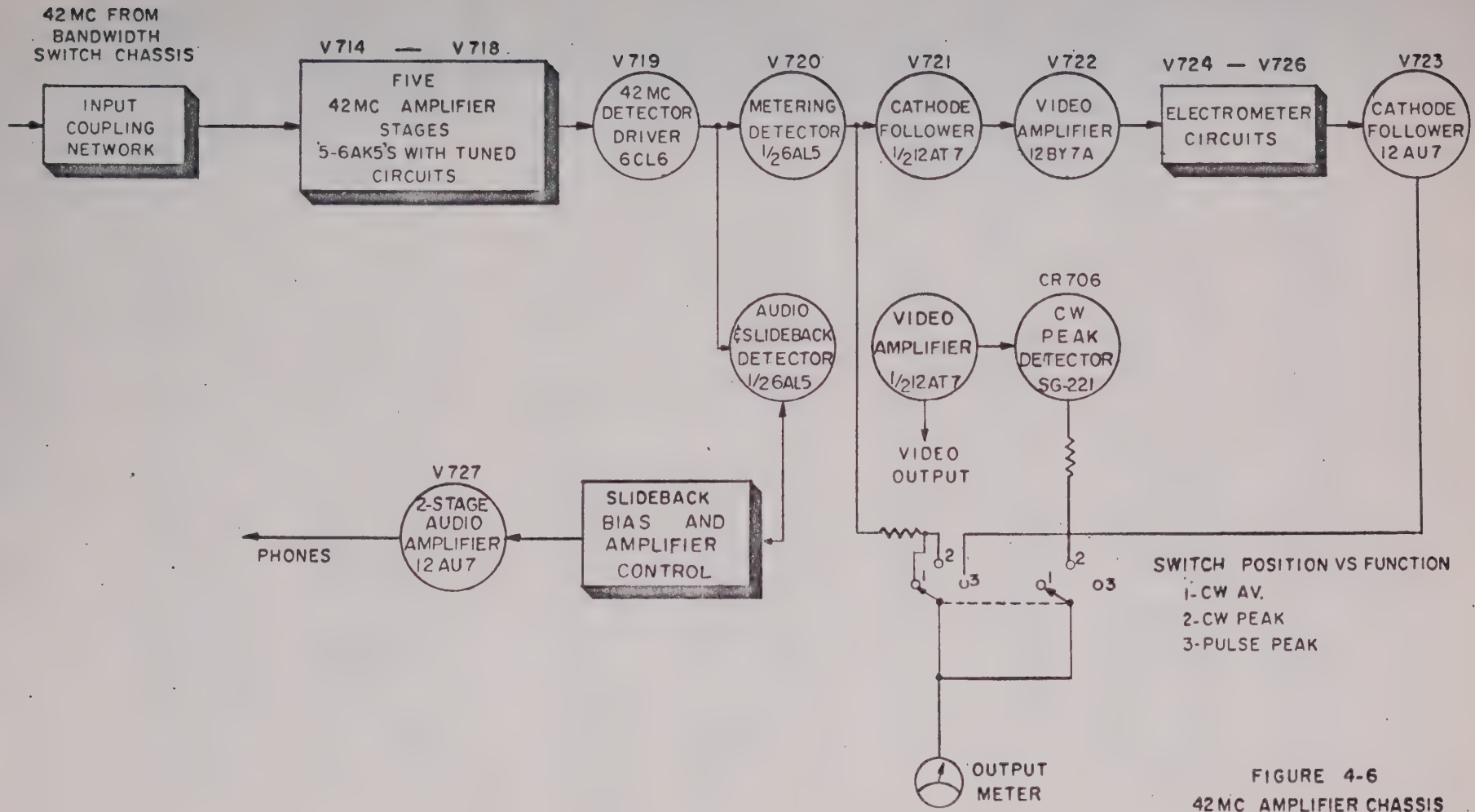



FIGURE 4-6
42MC AMPLIFIER CHASSIS

4.2.6.2 PULSE PEAK

In order to obtain the PULSE PEAK output to the meter, the output of the cathode follower half of V721 is coupled to V722, a 12BY7A tube capable of large dynamic range with video fidelity, which is used to drive the electrometer.

The split plate load of V722 provides two different levels of pulses which are fed to the two plates of V724, the electrometer detector. The large time constant networks of the detector (C821 - R780 and C822 - R781) permit efficient rectification of low duty cycle pulses. The DC signals thus produced are amplified by electrometer tubes V725 and V726 and meter amplifier tube V723.

The meter is connected between the cathodes of V723 to read the amplified difference between the two DC signals. This arrangement cancels any contact potentials and non-linearities of V724.

The ZERO ADJUST control, R789, adjusts for small differences in gain between the two channels and differences in contact potentials of V724.

4.2.6.3 Audio and Slideback Circuits

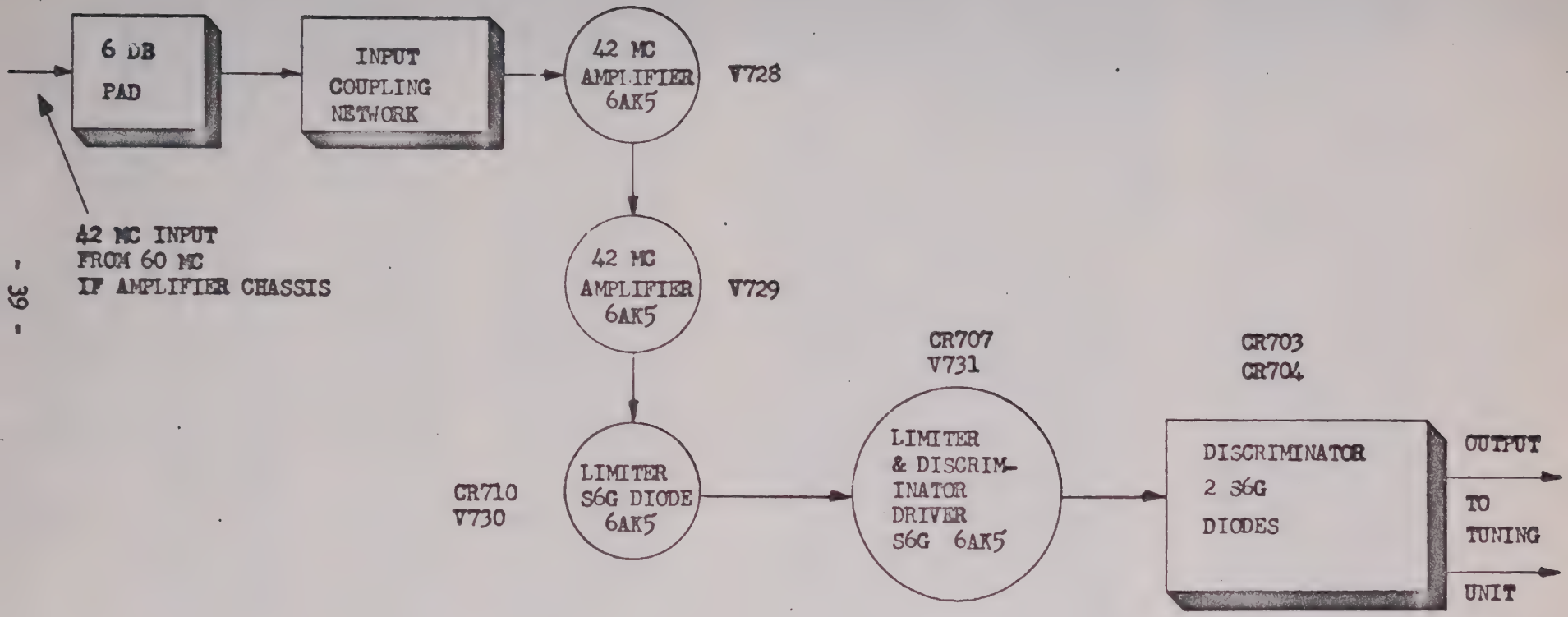
The output of the audio-slideback detector section of V720 is filtered and then applied across VOLUME control R796 in series with SLIDEBACK potentiometer R795. In the PULSE PEAK position of the Function Switch, variation of this control alters the magnitude of a negative bias which is applied through the filter network resistors, R762 and R763, to the detector plate. Thus, adjustment of this bias permits a "clipping" action, resulting in the detection of only the peak amplitudes of signals.

Signals thus detected are coupled from the VOLUME control through C838 to V727, a 12AU7 used as a 2-stage audio amplifier. The output of this amplifier is then transformer-coupled through T727, and transferred through filter FL1102 to the front panel PHONES jack, J1104.

4.2.7 AFC Chassis

For a block diagram of this chassis see Figure 4-7. After entering the AFC chassis through J716, the 42 MC signal passes through a 6 DB pad comprising resistors R885, R886, and R887, the purpose of which is to prevent shifting of center frequency when switching between WIDE and NARROW bandwidth. The signal is then transformed through a resonant network, consisting of C777 and L729, from the relatively low input impedance up to the grid of the 1st IF Amplifier stage V728.

After an additional stage of amplification in V729, the signal is coupled to a third 6AK5, in the grid circuit of which is connected an S6G silicon diode to assist in the function of limiting. The output of this 6AK5 is coupled to a second S6G/6AK5 combination which both performs a similar function of limiting and serves as a driver for the discriminator circuit.




AFC CHASSIS
FIGURE 4-7

The discriminator circuit is essentially conventional; a possible exception is that resistors R876 and R880 are shunted across the diodes to abet the stability and interchangeability of these devices. The entire discriminator is "floating" at the same potential as the grid circuit of the 6AS6 DC amplifier in the respective tuning units. As the polarity of the discriminator output reverses, this DC amplifier plate varies inversely; in this manner, the klystron repeller to which this plate is connected alters the klystron frequency so as to restore the IF frequency to the proper value.

### 4.2.8 Local Oscillator Chassis

The Local Oscillator Chassis is located on the left side of the hinged plate. It consists of one half of a crystal controlled 6J6 (V711A) which produces a signal of exactly 51 MC. This signal is coupled through a 50 pico-farad capacitor C917 to the second half of the 6J6 (V711B), which acts as a frequency doubler, increasing the frequency to 102 MC. This signal is then coupled, by means of a tuned circuit, through the 51 MC filter subchassis to the 42 MC mixer located in the 60 MC IF amplifier. It is also sent through a 50 pico-farad capacitor C915 to a 6AB4 (V712), which serves as the second frequency doubler. The 204 MC output of V712 is then coupled through a tuned circuit to the third frequency doubler, V713, which is a 6J4. The output of this stage is a 408 MC signal which is developed in a coaxial-type tuned circuit and transferred through a 408 MC coaxial high pass filter to the 348 MC mixer located in the 60 MC preamplifier chassis. Figure 4-8 is a block diagram of the local oscillator chassis and 51 MC filter.

### 4.2.9 Power Supply

The Power Supply furnishes regulated voltages of +150 volts, -150 volts, two sources of +1.2 volts, and two sources of +6.3 volts DC, in addition to -975 volts reflector voltage and -325 volts beam supply for the klystron. Regulation circuits make these voltages independent of changes either in the primary supply voltage or in the current drain of the various loads. A time delay relay in the supply delays application of the beam voltage for a period of 45 seconds after the reflector voltage has been applied to the klystron.

For each regulated voltage, the AC voltage on a separate secondary winding is rectified by solid-state diodes and sent to a separate regulating circuit. The main power transformer provides voltages to all rectifier circuits, with the exception that the beam (-325V.) supply is obtained from a separate transformer.

The outputs of the beam and reflector regulating circuits are connected across a voltage dividing network, providing regulated voltages of -325 volts and -975 volts, to ground. The outputs of the +150 volt and -150 volt regulating circuits are also connected across a voltage dividing network, which utilizes a potentiometer to provide adjustment of the +150 volt regulating circuit with respect to the -150 volt circuit. All four supplies use series regulators.

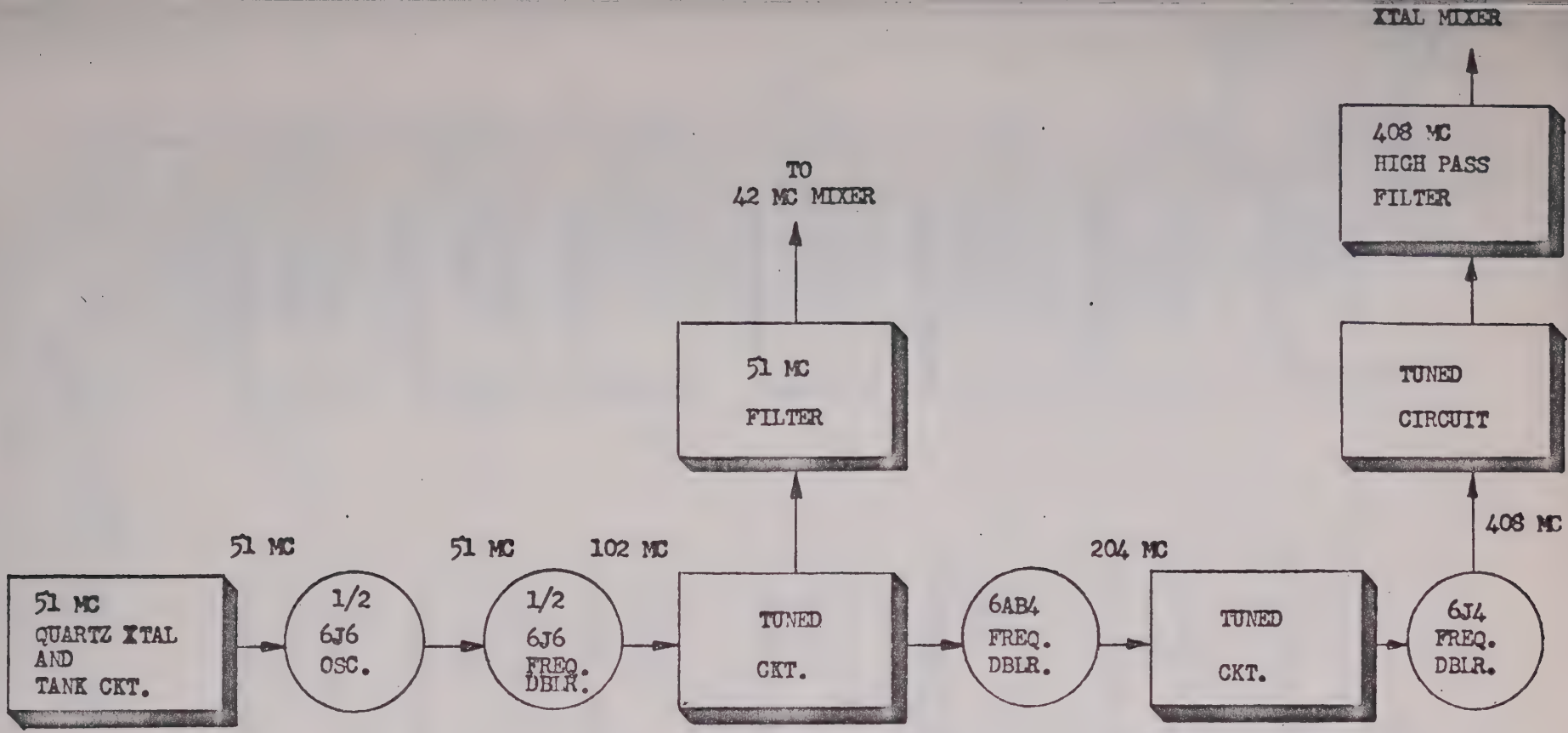



FIGURE 4-8
51 MC LOCAL OSCILLATOR
AND
51 MC FILTER

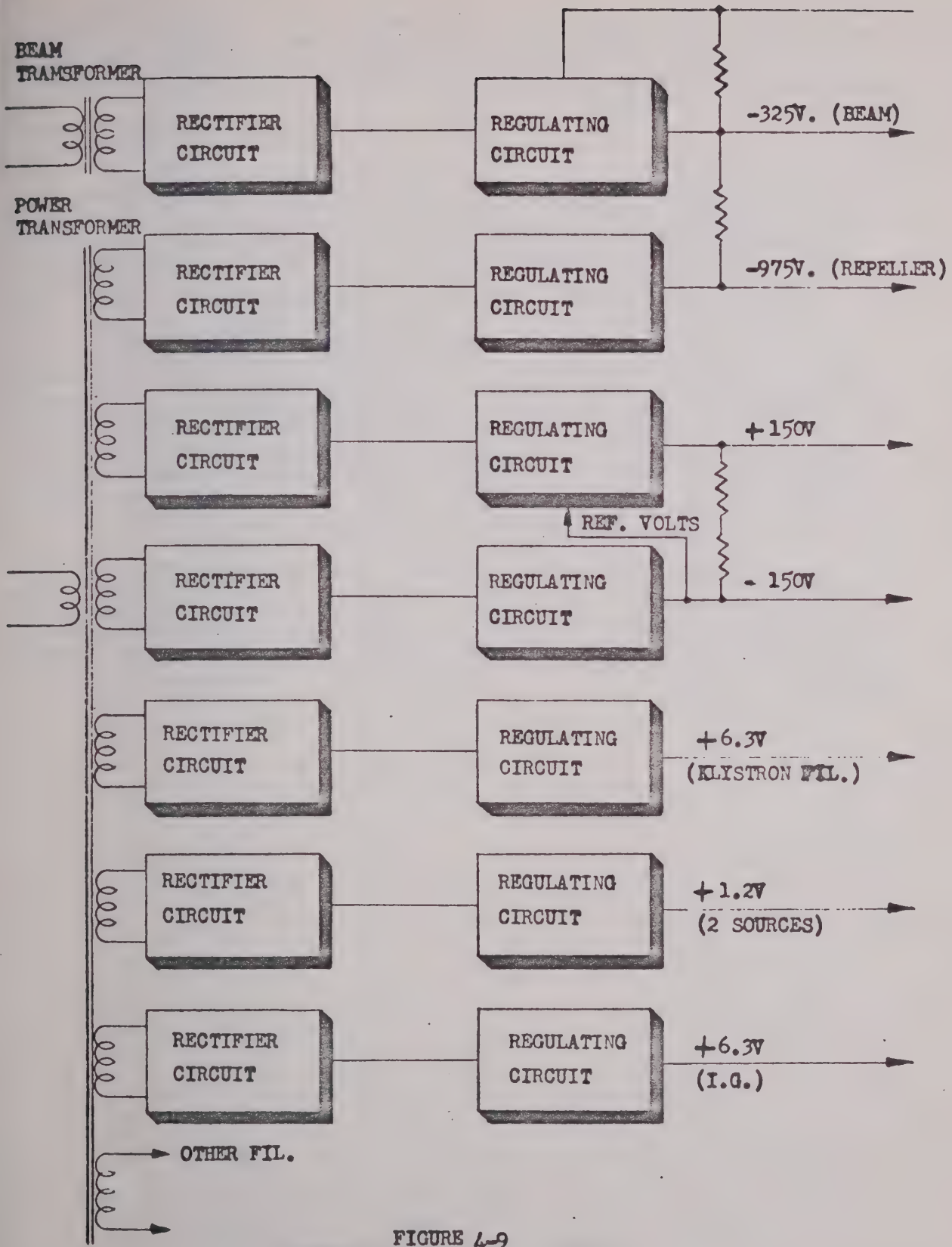



FIGURE 4-9
BLOCK DIAGRAM - POWER SUPPLY

Both the +1.2 volt electrometer filament supplies and the +6.3 volt klystron supply use zener diodes as shunt regulating devices while the +6.3 volt impulse generator supply employs a transistor series regulating circuit to provide the required higher degree of regulation.

### 4.2.10 Impulse Generator

The Impulse Generator serves as a standard impulse noise source for calibration of the instrument. It produces extremely short pulses which provide a uniform spectrum over the entire frequency range of the instrument. The pulse repetition rate of the generator is fixed at 400 cps, with pulse polarity reversed at a rate of 55 cps. The impulses are generated by abrupt discharge of a charged section of coaxial line.

When the IMPULSE GENERATOR ON-OFF switch S704 is closed (ON), +6.3 volts is sent simultaneously to transistors Q741 and Q742, the impulse generator driver, and to transistors Q702 and Q703, on the transistor chassis. The impulse generator drivers produce a square wave of 400 cps which drives the mechanical vibrator. The 55 cps square wave charging voltage produced by transistors Q702 and Q703 is applied through a 100-megohm charging resistor, thereby charging the coaxial line alternately positively and negatively. The mechanical vibrator discharges the line at a 400-cycle rate into a discharge line to produce the impulses.

The level of the charging voltage is controlled by the IMPULSE GEN. DB ABOVE 1 uV/MC switch on the front panel. This switch controls a precision voltage divider connected between the secondary of the charging voltage transformer and the charging resistor, which is located in one contact arm of the mechanical vibrator. Figure 4-10 is a block diagram of the impulse generator.

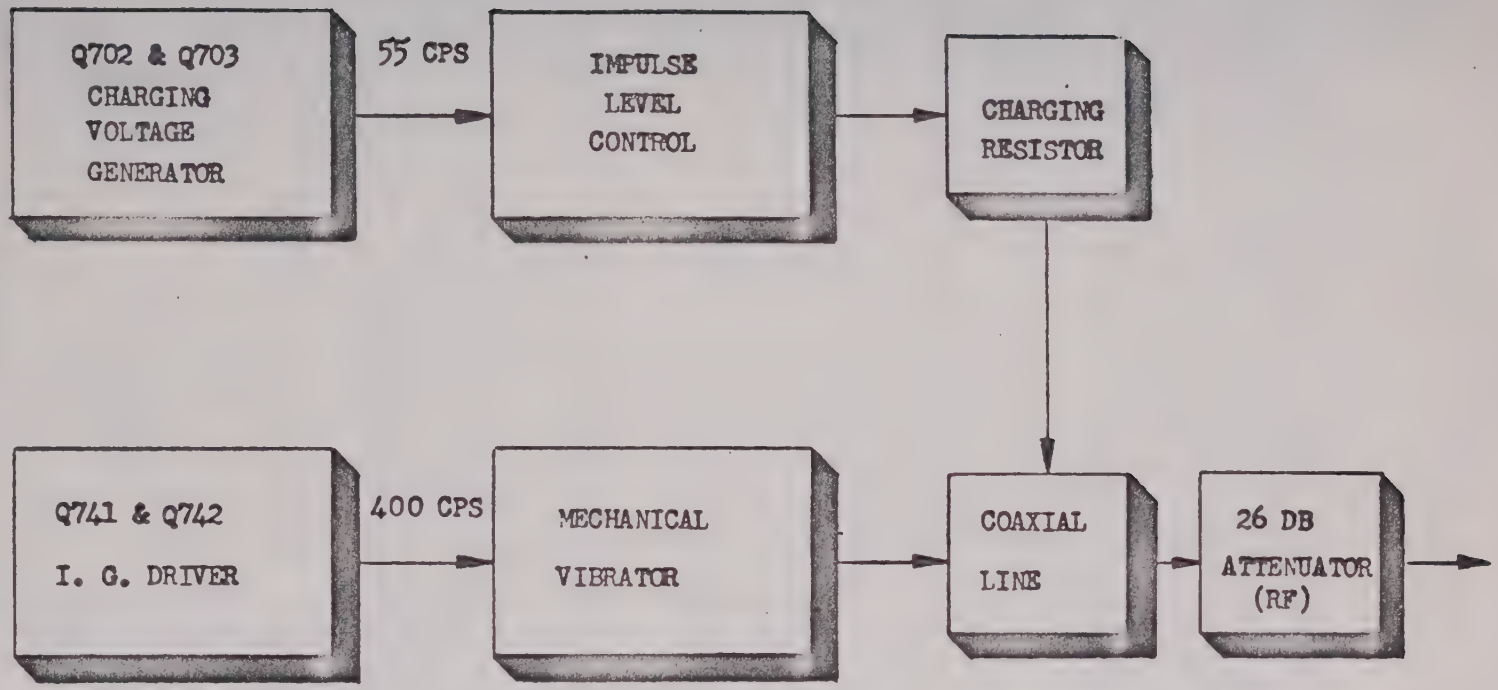



FIGURE 4-10
BLOCK DIAGRAM
IMPULSE GENERATOR

## SECTION V

## ALIGNMENT PROCEDURES

### 5.1 Main Unit

Although all sub-chassis will probably never require alignment at the same time, the procedures outlined in this section are based on the assumption that the system contains no malfunctions but that all sub-chassis are completely un-aligned. Under these conditions, or for checking alignment, the sequence of procedures outlined below should be followed.

With the exception of the bandwidth switch chassis and power supply, all sub-chassis requiring alignment are mounted on the hinged plate. See Figure 5-1.

The items of test equipment required for alignment of the main unit are listed below.

a. Signal generators capable of operation at 42, 51, 102, 348, 408, and 1000MC.

b. VTVM capable of accurately measuring DC voltage to 1000 volts.

c. 20,000 ohms/volt multimeter.

d. Noise and Field Intensity Meter, Empire Devices Model NF-105.

#### 5.1.1 Power Supply

a. Insert one of the tuning units and connect the NF-112 to a power source of 117 volts AC, 60 cps. Allow a 1-hour warm-up period.

b. Using an accurate VTVM, adjust the regulated voltages listed in the table below in the sequence shown. Please note that readjustment of these voltages from their original factory settings will probably necessitate retracking the tuning unit klystrons. All voltage adjustment controls are located on the right side of the main unit, near the bottom edge. The power supply schematic diagram and Figure 5-2 may be used as an aid.

| VOLTAGE | CONNECT VOLTMETER BETWEEN | | ADJUST |
|---|---|---|---|
| -150V. | TB1102-2 | Gnd. | R1151 |
| +150V. | TB1102-1 | Gnd. | R1141 |
| +6.3V. | TB1102-12 | Gnd. | R1156 |
| (#1)+1.2V. | TB1102-6 | TB1102-7 | R1128 |
| (#2)+1.2V. | TB1102-8 | TB1102-9 | R1130 |
| -325V. | TB1101-4 | Gnd. | R1110 |
| -975V.* | TB1101-3 | Gnd. | R1123 |

* Power switch must be in the "KLYSTRON" position and the "KLYSTRON" light must be "on".

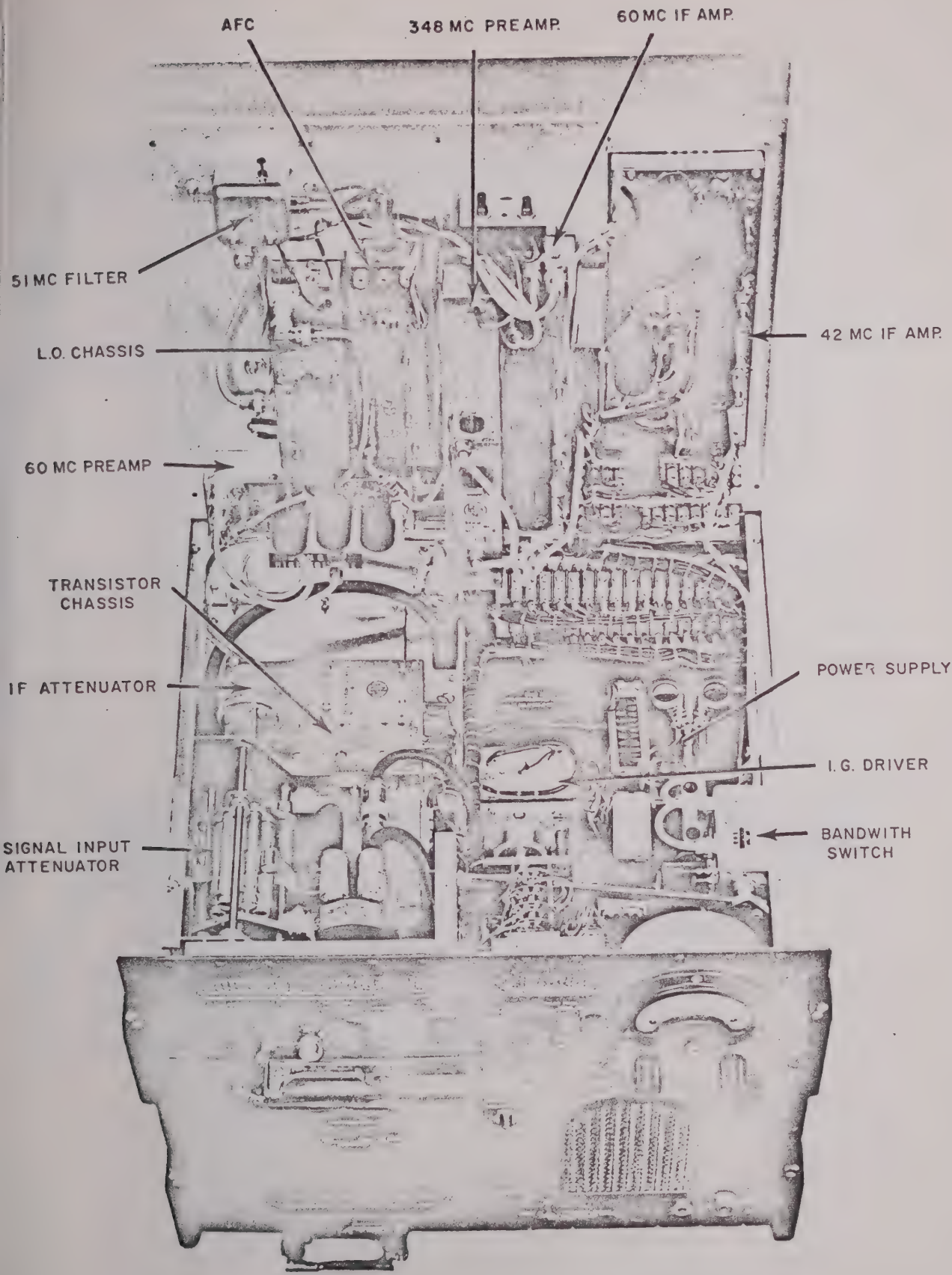



FIGURE 5-1. INSIDE MAIN UNIT WITH HINGED PLATE UP

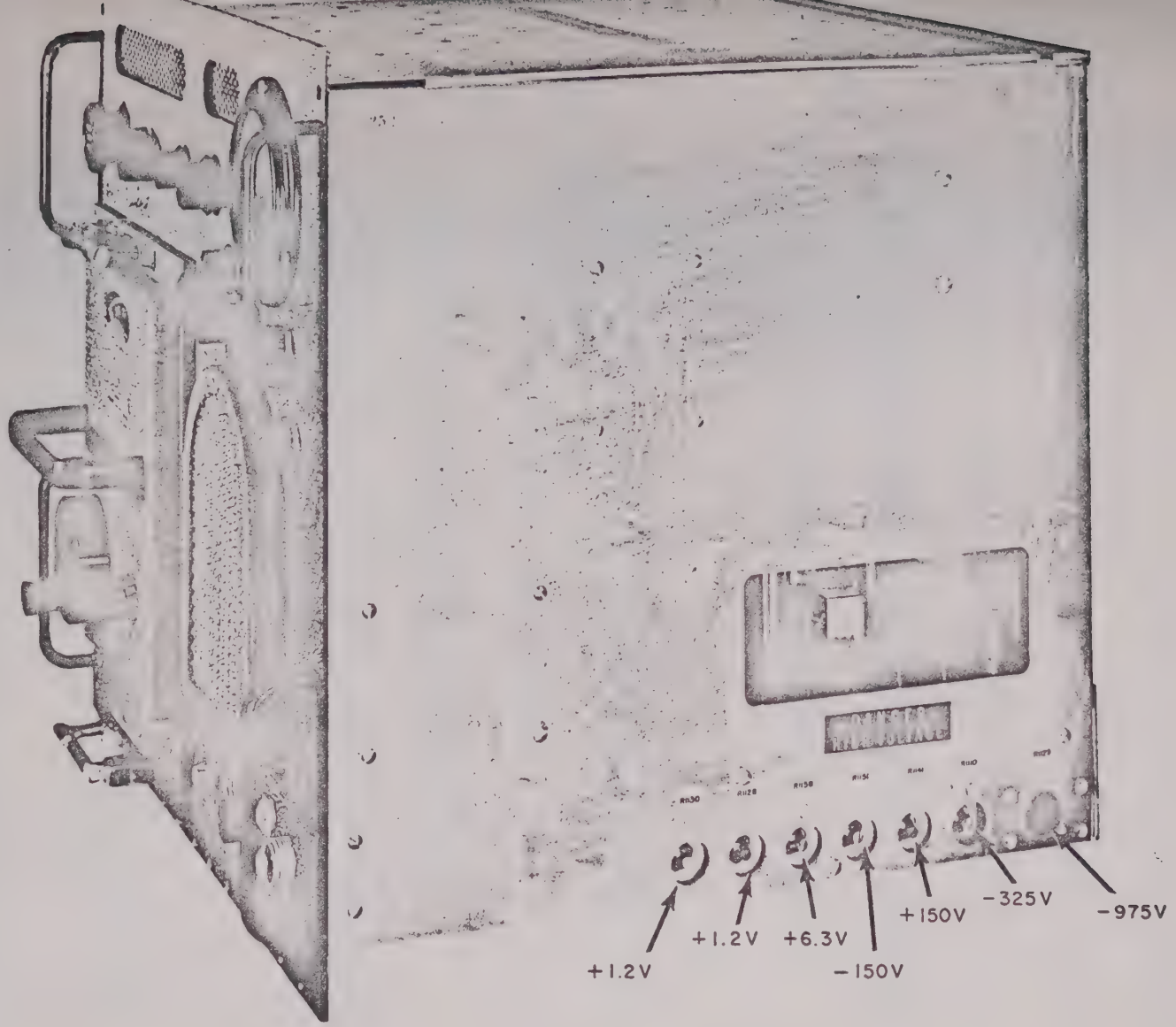



FIGURE 5-2. POWER SUPPLY VOLTAGE ADJUSTMENTS

5.1.2 42 MC IF Amplifier

a. Set the function switch to CW AVERAGE and feed a 42 MC signal into J712 located on the 42 MC sub-chassis.

b. Adjust the signal generator level to obtain an indication on the front panel meter.

c. Adjust coils L722 through L728, in that order, for maximum meter indication.

d. Adjust the signal generator output level to obtain a full scale indication. The output level required should not be higher than 7000 microvolts.

e. Disconnect the signal generator and reconnect P722 to J712.

5.1.3 Local Oscillator

5.1.3.1 102 MC

a. Remove the cover. Disconnect P720 from J708 on the 60 MC IF amplifier sub-chassis and connect it to an Empire Devices Model NF-105, Noise and Field Intensity Meter which is tuned to 102 MC.

b. Adjust the Model NF-105 to obtain an indication on its front panel meter.

c. Adjust L719 and L720 on the local oscillator sub-chassis for maximum indication on the NF-105 meter (1.5 volts minimum).

d. Tune the NF-105 to 51 MC and adjust L772 and L735 on the 51 MC filter for a minimum indication on the NF-105 meter. Readjust several times to insure absolute minimum indication. If unable to reach minimum indication by tuning L772, screw out L719, located on the local oscillator, 2 turns, then readjust L772 for minimum indication.

e. Disconnect the NF-105 and reconnect P720 to J708.

5.1.3.2 408 MC

a. Disconnect P711 from J711 on the local oscillator sub-chassis and connect the NF-105 to J711.

b. Tune the NF-105 to 408 MC.

c. Adjust L721, C719 and C720 for maximum indication on the NF-105 meter (0.3 to 2.5 volts).

d. Disconnect the NF-105 and reconnect P711 to J711.

5.1.4 60 MC IF Amplifier

a. With the function switch set to CW AVERAGE, set the BANDWIDTH switch to WIDE and set the SIGNAL INPUT ATTENUATOR to 20 DB.

b. Disconnect P726 from J706 on the 60 MC IF preamplifier sub-chassis and feed a 60 MC signal into P726.

c. Adjust the GAIN control and signal generator level to obtain a suitable indication on the front panel meter.

d. Adjust L711, L712, L713, L714, L715, L716 and L718 for maximum indication of the meter.

e. Set the SIGNAL INPUT ATTENUATOR to 0 DB, turn the GAIN control fully clockwise and adjust the signal generator output level to obtain a full scale indication. The output level required should not be higher than 150 microvolts. Set the SIGNAL INPUT ATTENUATOR to 20 DB.

f. Disconnect the signal generator and reconnect P726 to J706.

5.1.5 60 MC IF Preamplifier

a. Disconnect P702 from J704 on the 60 MC IF preamplifier sub-chassis and feed a 348 MC signal into J704.

b. Adjust the GAIN control for an indication on the front panel meter so that the signal level is well above the noise.

c. Adjust L701, L702, L704 and L705 for maximum indication on the meter at each coil.

d. Turn off the signal generator.

e. Disconnect P726 from J706 and connect to J706, the NF-105 which is tuned to 51 MC.

f. Adjust L703 for minimum indication on the NF-105 meter.

g. Disconnect the Model NF-105 and reconnect P726 to J706.

h. Turn the signal generator "off" and adjust the GAIN control for a 20 DB indication of noise. Turn the signal generator back "on" and adjust its output level for a 10 DB rise on the front panel meter. The signal generator output level required should be in the range of 14 to 24 microvolts.

i. Disconnect the signal generator from J704 and reconnect P702 to J704.

5.1.6 348 MC IF Preamplifier

a. Turn the POWER switch OFF.

b. Connect a milliammeter in series with the B+ line at the feed-thru capacitor located on the 348 MC IF preamplifier sub-chassis (the red lead must be unsoldered).

c. Turn the POWER switch to STANDBY and allow the unit to warm up for a few minutes.

d. Adjust R863, left-hand potentiometer of the two located next to the 348 MC preamplifier, for a reading of 10 milliamperes on the milli-ammeter.

e. Turn the POWER switch OFF, disconnect the multimeter and resolder the B+ lead to the feed-thru capacitor.

f. Return the POWER switch to STANDBY and allow a few minutes warm-up.

g. Set the SIGNAL INPUT ATTENUATOR to 0 DB and adjust the GAIN control for a half-scale indication of noise on the front panel meter.

h. Disconnect the signal (coaxial) cable running from the tuning unit to J701 on the 348 MC preamplifier sub-chassis, and connect a signal generator to P701. Do not turn the signal generator "on".

i. Adjust C704 for minimum indication of noise on the meter.

j. Set the GAIN control for an indicated noise level of 20 DB.

k. Set the SIGNAL INPUT ATTENUATOR to 20 DB, turn the signal generator on and adjust it at 348 MC for a convenient meter indication.

l. Adjust C703 on the 348 MC preamplifier and C701 on the 60 MC preamplifier for maximum indication of the meter.

m. Readjust C719 and C720 on the local oscillator sub-chassis, for maximum meter indication.

n. Turn the signal generator "off", but leave it connected.

o. Set the SIGNAL INPUT ATTENUATOR to 0 DB and adjust the GAIN control for an indicated noise level of 20 DB.

p. Turn the signal generator "on" and adjust the output level for a 10 DB rise on the meter. Note the output level of the signal generator. This should be within the range of 3.5 to 5 microvolts.

5.1.7 Wide-Narrow Bandwidth Switch

a. Turn the signal generator off and adjust the GAIN control for a 20 DB indicated noise level.

b. Set the SIGNAL INPUT ATTENUATOR to 20 DB and place the BANDWIDTH switch in the WIDE position.

c. Turn the signal generator on and tune it about the 348 MC point to obtain peak indication on the meter. To insure absolute correlation between the "WIDE" and "NARROW" BANDWIDTH switch positions, the 348 MC signal must be carefully peaked and then held at center frequency.

d. Change the BANDWIDTH switch to the NARROW position and if necessary, adjust the signal generator output level for an on-scale meter reading.

e. Adjust L759 and L760 for maximum meter indication.

f. Switch the BANDWIDTH switch back and forth between the WIDE and NARROW positions and adjust R782 (narrow band gain only), located on the hinged plate, for an equal meter reading in both positions.

g. Disconnect the signal generator and connect an Empire Devices Model IG-102 Impulse Generator in its place.

h. Turn the function switch to PULSE PEAK and the BANDWIDTH switch to WIDE.

i. Turn "on" the IG-102 and adjust its level to obtain a full scale indication.

j. Change the BANDWIDTH switch to NARROW and note the difference in meter reading. This difference should be 12-15 DB. If necessary, adjust C933 to obtain this degree of difference between WIDE and NARROW positions. Adjust for 14 DB.

k. Disconnect the IG-102, reconnect the signal generator, turn the function switch to CW AVERAGE and repeat steps "a" through "j" above to insure optimum alignment.

l. Disconnect the signal generator and reconnect P701.

m. Install a T-1 Tuning Unit tuned to 1 KMC and connect a signal generator (tuned to 1 KMC) to the SIGNAL INPUT jack on the front panel. Repeat steps "c" through "j" above at 1 KMC.

n. Connect the IG-102 in place of the signal generator and repeat steps "g" through "j" above going through the tuning unit.

5.1.8 AFC Alignment

a. Remove the tuning unit from its main unit well.

b. Disconnect P736 from J716 on the AFC sub-chassis and connect a signal generator to J716.

c. Connect a VTVM between either TP701 or TP703 and TP702.

d. Feed in a 42 MC signal whose level is high enough to give a good indication on the VTVM, but below the limiting level of the AFC.

e. Adjust L729, L730, L731, L732 and L733 for maximum indication on the VTVM, always keeping the input signal level below the limiting level of the AFC.

f. Increase the level of the input signal gradually until the indication on the VTVM ceases to change. This is the limiting level and should be noted (100 to 300 microvolts).

g. Adjust the VTVM for a "zero" center reference, and connect it between TP701 and TP703.

h. Adjust L734 for "zero" center indication on the VTVM with the input signal level at the maximum output of the signal generator.

i. Vary the frequency of the signal generator to either side of the center frequency and note the voltage variation from "zero" center (greater than 2 volts DC).

j. Disconnect the signal generator and VTVM; reconnect P736 to J716.

k. Install the tuning unit (with AFC switch OFF) in the main unit well and connect a signal generator to the SIGNAL INPUT connector on the front panel. Do not turn the signal generator on.

l. Set the function switch to CW AVERAGE and the SIGNAL INPUT ATTENUATOR to 0 DB.

m. Adjust the GAIN control for a 20 DB noise indication on the front panel meter.

n. Set the BANDWIDTH switch to NARROW.

o. Turn on the signal generator and tune the tuning unit to the signal generator frequency, or for maximum meter indication.

p. Turn the AFC switch ON and adjust L734 for maximum meter indication. This indication should be the same as that obtained in step "o" above.

q. Adjust the signal generator output level for a full scale indication on the front panel meter.

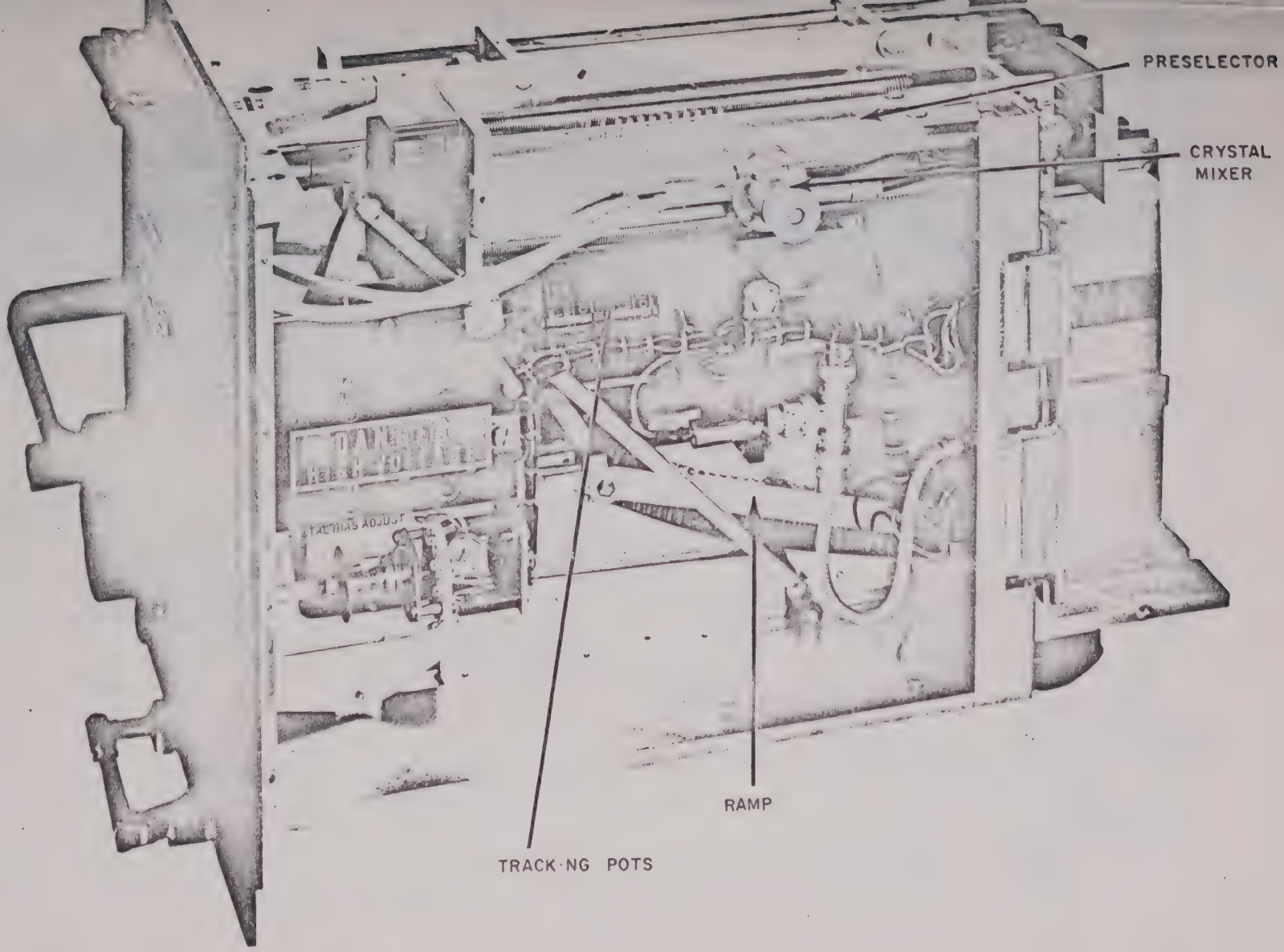



FIGURE 5-3. TYPICAL TUNING UNIT (RIGHT, INSIDE)

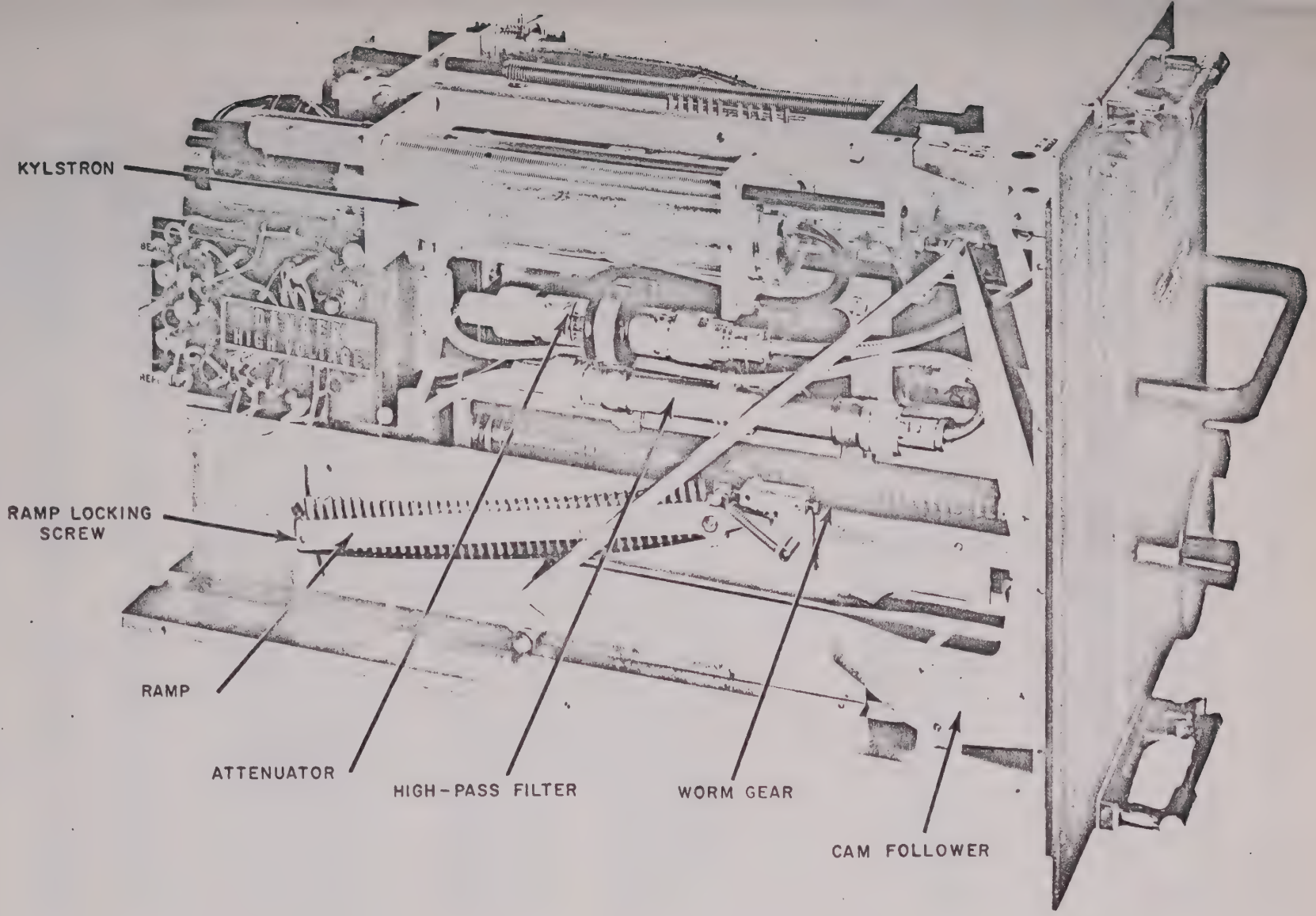



FIGURE 5-4. TYPICAL TUNING UNIT (LEFT, INSIDE)

b. Connect a wavemeter, detector and microammeter to the output of the klystron as shown in Figure 5-5.

c. Observe the output of the klystron and adjust the KLYSTRON LOW potentiometer for maximum indication on the microammeter.

d. Turn the tuning control to the upper limit, loosen the ramp locking screw and adjust the ramp position for maximum indication on the microammeter. Tighten the ramp locking screw.

e. Adjust the KLYSTRON HIGH potentiometer for maximum indication on the microammeter.

f. Return the tuning control to the lower limit and tune the wavemeter to obtain a dip on the microammeter * which indicates the klystron frequency. For example, for a dial reading of 1500 MC, the klystron frequency should be 1848 MC. For vernier adjustment of this frequency, adjust the ramp screw adjacent to the roller bearing of the rocker arm to the exact frequency.

g. Adjust the KLYSTRON LOW potentiometer for maximum indication on the microammeter.

h. Turn the tuning control to the upper limit and tune the wavemeter to obtain a dip on the microammeter. This should be at 348 MC above the indicated upper limit for Tuning Units T-1 and T-2. On Tuning Units T-3 and T-4, this frequency is the dial reading plus 348 MC divided by two. For example: if the dial reading is 7000, the required klystron frequency is (7000 + 348)/2 = 7348/2 = 3674 MC. If necessary, adjust the end ramp screw nearest the rear of the unit to obtain this frequency.

i. Adjust the KLYSTRON HIGH potentiometer for maximum indication on the microammeter. In the case of Tuning Unit T-4, tune to 9.3 KMC and adjust ramp screw to obtain a dip on the wavemeter at (9300 + 348 MC)/2, then readjust the klystron high potentiometer, remove the screw adjacent to the roller bearing at this frequency and return the tuning control to its lower limit, then complete steps "j" and "k".

j. Starting from the high or low end, turn the tuning control until the roller bearing of the cam follower is lined up tangent to the end of each ramp screw. Observe the dial reading and adjust each screw until the klystron frequency is exactly 348 MC above the dial frequency in heads T-1 and T-2 and (dial reading + 348 MC)/2 in heads T-3 and T-4. Continue this operation for every ramp screw throughout the tuning range. Crank the tuning control over the entire range and note that all ramp screws touch the spring under which the roller bearing rides.

k. Again crank the tuning control over the entire range, observing the microammeter for any "holes" or dead spots in the output of the klystron.

* If an absorbtion type wavemeter is used, <u>always</u> utilize the <u>highest</u> frequency indication.

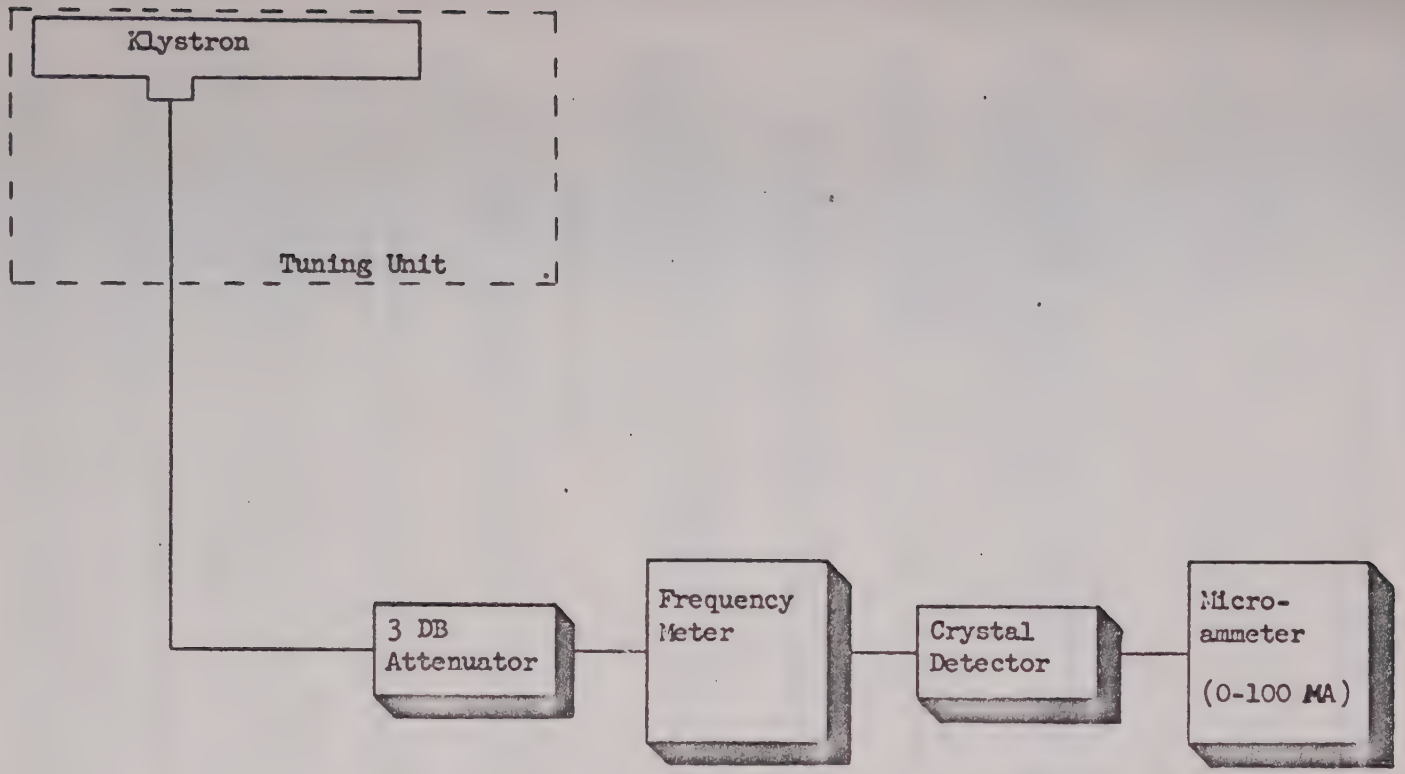



Figure 5-5
Test Set Up
Klystron Tracking

### 5.2.3 Preselector Tracking

Do not attempt to track the preselector until the klystron has been tracked, or ascertained to be in a tracked condition.

a. Connect a signal generator to the signal input interconnecting connector on the rear of the tuning unit (RF input) and connect the tuning unit to the main unit with the alignment harness.

b. Turn the power ON and allow 1 hour warmup.

c. Set the tuning control to the low end of the dial. Adjust the signal generator frequency until an indication is noted on the main unit microvolt meter. (A high level of output from the signal generator may be required to obtain an indication.)

d. When a peak reading is reached, adjust the vernier ramp screw adjacent to the roller bearing until maximum indication is obtained on the meter.

e. Turn the tuning control to the high end of the dial and adjust the signal generator frequency for an indication on the main unit meter.

f. Loosen the ramp locking screw at the extreme end of the ramp and adjust the ramp position for maximum indication on the meter. Tighten the ramp locking screw. Fine adjustment can be made with the ramp screw adjacent to the roller bearing.

g. Replace stiffener.

h. When the maximum meter indication has been obtained, adjust the piston alignment screws on the end of each piston to obtain an absolute peak.

i. Return the tuning control to the low end of the dial and check the indication on the main unit meter. Readjust if necessary.

j. Beginning at the low end of the dial, set the tuning control so that the roller bearing is tangent to the end of each succeeding ramp screw, tune the signal generator for maximum meter indication, and adjust the ramp screw for a peak indication.

k. Check that each adjustment screw touches the ramp adjacent to the roller throughout the range.

l. Tune the unit to the frequency indicated in the chart below and adjust the crystal bias control for maximum sensitivity at that frequency.

| Tuning Unit | Adjust | Frequency Point |
|---|---|---|
| T-1 | R111 | .85 KMC |
| T-2 | R211 | 4.0 KMC |
| T-3 | R312 | 3.9 KMC |
| | S302* | 5.4 KMC |
| | R310 | 7.1 KMC |
| T-4 | R410 | 7.0 KMC |

* On T-3, S302 is a micro-switch used to switch the mixer crystal current from constant current amplifier control in the range from 3.9 KMC to 5.4 KMC, to a self bias arrangement from 5.4 KMC to 7.1 KMC.

## SECTION VI

## REPAIR INSTRUCTIONS

### 6.1 General

The procedures employed in the repair of this equipment are largely conventional as far as the electronic circuits are concerned. It is the purpose of these instructions to point out any unusual procedures that might be helpful in making repairs. Such instructions are desirable for maintenance of the following units.

a. 348 MC IF Preamplifier

b. Tracking Potentiometer Assembly

c. Klystron Removal and Replacement

d. Mechanical Drive System Tracking

e. Signal Input Attenuator

### 6.2 348 MC IF Preamplifier

The 348 MC IF preamplifier sub-chassis is mounted on the hinged plate of the basic unit. To remove or replace the type 6299 tube, complete the following steps:

a. Remove the basic unit from its case and tip the hinged plate back.

b. Unsolder the "B+" and "filament" leads from the feed-thru terminals on the preamplifier.

c. Disconnect the connectors on the two coaxial cables leading into the preamplifier and loosen the plastic clamp securing the input cable. If the cables are secured to other cables by means of lacing cord, cut this cord.

d. Remove the four screws which secure the preamplifier to the hinged plate and remove the preamplifier.

e. Remove the 14 spring clips and two screws that secure the cover to the sub-chassis housing and take the cover off.

f. Unsolder the wire that is connected to the center conductor of the coaxial input cable at J701.

g. Unsolder the filament coil at the end of the coaxial structure that is held by the rectangular collar.

h. Remove the three screws which secure the rectangular collar to the sub-chassis housing, thus loosening the collar within the housing.

i. Two set screws which secure the collar to the coaxial structure are held in place by the two side screws of those mentioned in step "h" above. Loosen these set screws and slide the coaxial structure toward the front panel until the tube can be removed. Loosen the tube retaining clip. Remove and replace the tube if defective.

j. Slide the coaxial structure back into place and tighten the set screws and tube retaining clip. Resolder the wire and coil.

k. Replace the three screws removed in step "h" above. Replace the sub-chassis cover clips and securing screws.

l. Re-mount the assembly and reconnect cables and leads.

## 6.3 Tracking Potentiometer Assembly

To remove and replace the tracking potentiometer assembly, complete the following steps. Be absolutely certain that the assembly is defective before proceeding.

a. With the tuning unit dust cover removed, lay the tuning unit on its left side.

b. Looking down on the right side of the tuning unit, near the front, remove the three screws which secure the protective plastic plate covering the AFC wafer switch and bakelite mounting for screwdriver controls. Remove the protective plastic cover.

c. Loosen the collar which couples the AFC switch to the plexiglass shaft.

d. Remove the two screws which hold the support bar running diagonally between the two ends of the cam follower on the right side of the tuning unit. If necessary, in order to reach thw screw nearest the top of the tuning unit, loosen the collar holding the IF filter and slide the filter back toward the rear of the tuning unit.

e. Turn the tuning unit so that it rests on its bottom frame and the left side is accessible.

f. Unsolder the leads from both tracking potentiometers. Remove the leads one at a time, marking each lead as it is removed with the terminal number and the potentiometer (front or rear).

g. On the left side of the tuning unit, remove the 2 screws which hold the bracket containing the potentiometer assembly, AFC wafer switch and screw driver adjustments to the frame. Remove the bracket.

h. To remove the assembly from the bracket, simply remove the gear from the shaft and loosen the three mounting screws holding the bakelite base to the bracket.

i. Replace the defective assembly and reassemble the affected components of the tuning unit in reverse order.

6.4 Klystron Removal and Replacement

The klystron local oscillator is located in the upper left corner of the tuning unit. To remove the reflex klystron tube from the resonant cavity, proceed as follows, using Figure 6-1 as a guide.

a. Loosen the clamp which secures the tube shield to the cavity housing.

b. Remove the tube shield by pulling gently straingt out. If the socket does not come off with the shield, pull it gently straight back also.

NOTE: Never apply side motion or pressure to the klystron tube since this tube is very fragile.

c. Using spanner wrench TK-112, loosen the tube retainer nut.

d. Grasp the tube firmly and rotate it slowly clockwise as marked on the klystron cavity, at the same time pulling straight out. (If no instruction regarding direction of rotation is present, rotate the tube counter-clockwise.)

e. After removing the tube from the cavity, inspect the holding spring for damage and replace if required. To replace the spring, remove the spanner nut and sleeve. Replace the damaged spring, followed by the sleeve and spanner nut in the reverse order from which they were removed.

f. To replace the klystron tube, push the tube straight into the cavity gently, rotating the tube slowly in a clockwise direction, as marked on the klystron cavity. (As in step d, rotate counter-clockwise if no note appears on the cavity.)

g. Using the spanner wrench, tighten the tube retainer nut until it is approximately 1/3 turn past the point of contact with the spring retainer, or to 30 $\pm$ 5 inch lbs.

h. Replace the socket, being careful not to apply any side pressure to the tube.

i. Replace the shield and clamp. Tighten the clamp.

NOTES: 1. Extreme caution must be exercised when removing and replacing the klystron tube since the tube used is very fragile.

2. The klystron must be mechanically tracked per paragraph 5.2.2 when the tube is replaced.

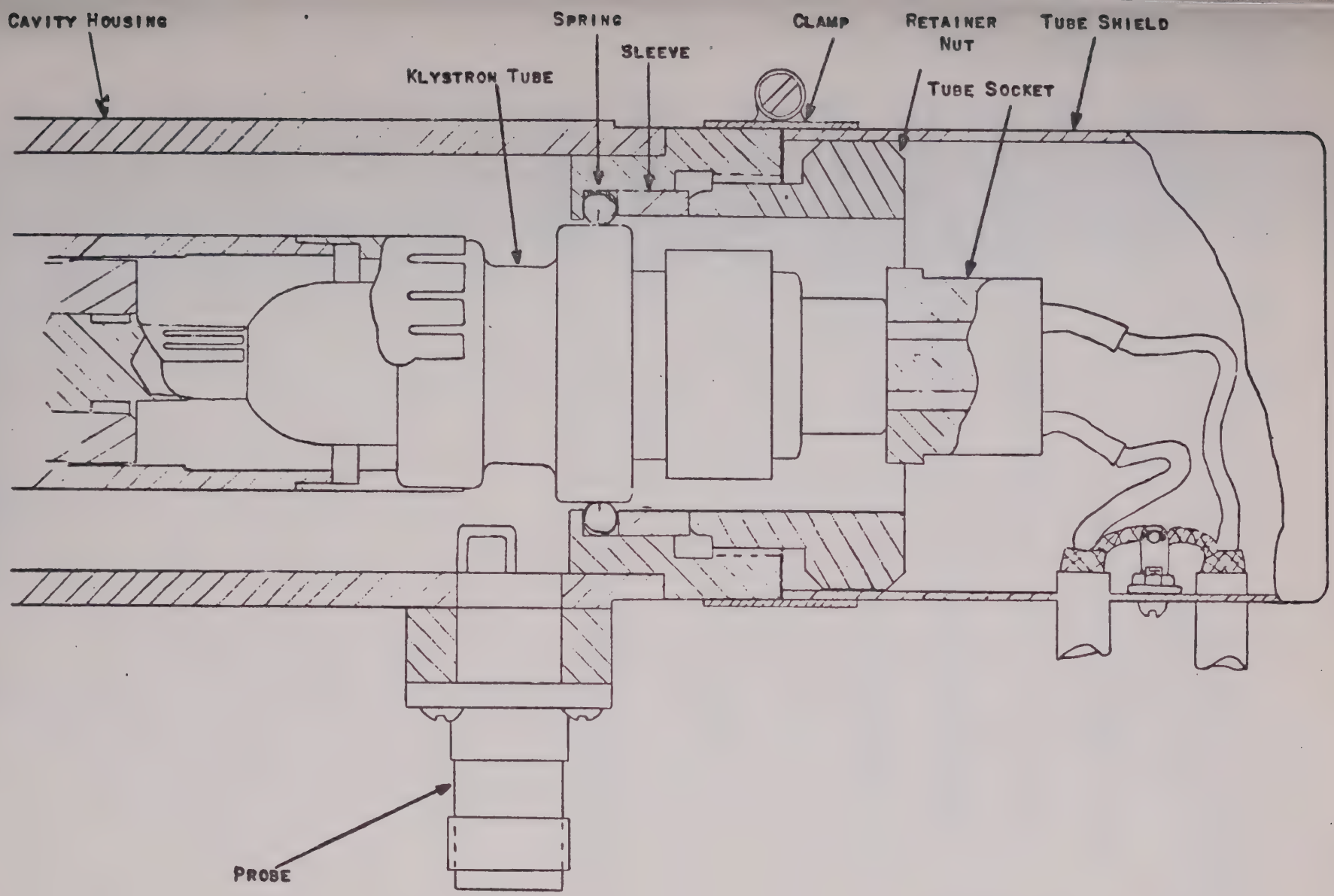



FIGURE 6 - 1
KLYSTRON LOCAL OSCILLATOR

## 6.5 Signal Input Attenuator

After it has been established that one of the steps of the attenuator varies from the nominal value, the attenuator must be removed from the basic measuring unit to be repaired. To remove and repair the attenuator, the following procedure should be followed.

a. Remove the control knob located on the front panel from the shaft.

b. Disconnect the cables leading into the attenuator from the coaxial switch and the tuning unit cavity.

c. Remove the screws which secure the two attenuator mounting brackets to the basic measuring unit chassis. Now the attenuator assembly may be lifted out of the basic measuring unit.

d. To take the attenuator apart, remove the three number 6 screws attached to the rear of the three tie rods. Remove the bracket and rear plate.

e. Remove the screw which connects the link to the rear moving plate and pull the plate out. The barrel is now loose.

f. Remove the barrel assembly and replace if defective.

g. Reassemble the attenuator in reverse order. Make certain of good alignment by checking connector fits.

h. Replace attenuator in the basic measuring unit, secure the mounting brackets to the side panel of the basic measuring unit and replace the control knob.

## SECTION VII

## PARTS LIST FOR

## NOISE AND FIELD INTENSITY METER MODEL NF-112

For simplicity the designation of the main components in the following list is shown in abbreviated form; thus BA-112 is BA, T-1/NF-112 is T1, etc., see list of components, Section I, par. 1.4.

### I. ATTENUATORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| AT101 | Attenuator; 10 DB | Klystron ckt., T1 |
| AT201 | Attenuator; 20 DB | Klystron ckt., T2 |
| AT301 | Attenuator; 6 DB | Klystron ckt., T3 |
| AT401 | Attenuator; 3 DB | Klystron ckt., T4 |
| AT701 | Attenuator, variable; step | Signal input, BA |

### II. CAPACITORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| C101 | .05 mfd, 1000 V | Klystron ckt., T1 |
| C102 | .05 mfd, 1000 V | " |
| C103 | 35 mfd, 350 V | DC Amp. ckt., T1 |
| C104 | 1000 pf, feed-thru | Preselector ckt., T1 |
| C201 | .05 mfd, 1000 V | Klystron ckt., T2 |
| C202 | .05 mfd, 1000 V | Klystron ckt., T2 |
| C203 | 35 mfd, 350 V | DC Amp. ckt., T2 |
| C301 | .05 mfd, 1000 V | Klystron ckt., T3 |
| C302 | .05 mfd, 1000 V | Klystron ckt., T3 |
| C303 | 35 mfd, 350 V | DC Amp. ckt., T3 |
| C401 | .05 mfd, 1000 V | Klystron ckt., T4 |
| C402 | .05 mfd, 1000 V | Klystron ckt., T4 |
| C403 | 35 mfd, 350 V | DC Amp. ckt., T4 |
| C701 | 1.5-7 pf, trimmer | 348 MC Preamp., BA |
| C702 | 1000 pf, stand-off | " |
| C703 | Special, tuning slug (A61060) | " |
| C704 | Special, tuning slug (A61060) | " |
| C705 | 1000 pf, feed-thru | " |
| C706 | 1000 pf, feed-thru | " |
| C707 | 1000 pf, feed-thru | " |
| C708 | 1000 pf, stand-off | 60 MC Preamp., BA |
| C709 | 500 pf, dura mica | " |
| C710 | 1000 pf, stand-off | " |
| C711 | 1000 pf, stand-off | " |
| C712 | 500 pf, dura mica | " |
| C713 | 1000 pf, stand-off | " |
| C715 | 1000 pf, stand-off | " |

II. CAPACITORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| C717 | 47 pf, dura mica | 60 MC Preamp., BA |
| C718 | 1000 pf, feed-thru | " |
| C719 | 4-12 pf, tubular trimmer | Local osc., BA |
| C720 | 4-12 pf, tubular trimmer | " |
| C721 | 1000 pf, feed-thru | 60 MC Preamp., BA |
| C722 | 1000 pf, stand-off | 60 MC Amp., BA |
| C723 | 1000 pf, stand-off | " |
| C724 | 1000 pf, stand-off | " |
| C725 | 1000 pf, stand-off | " |
| C726 | 1000 pf, stand-off | " |
| C727 | 50 pf, tubular ceramic | " |
| C728 | 1000 pf, stand-off | " |
| C729 | 1000 pf, stand-off | " |
| C730 | 150 mfd | Transistor chassis, BA |
| C731 | .05 mfd, 1 KV | " |
| C732 | 1000 pf, feed-thru | " |
| C733 | 1000 pf, stand-off | 60 MC Amp., BA |
| C734 | 1000 pf, stand-off | " |
| C735 | 50 pf, tubular ceramic | " |
| C736 | 1000 pf, stand-off | " |
| C738 | 1000 pf, feed-thru | " |
| C739 | 1000 pf, feed-thru | " |
| C740 | 1000 pf, stand-off | " |
| C741 | 1000 pf, stand-off | " |
| C742 | 1000 pf, stand-off | " |
| C743 | 1000 pf, stand-off | " |
| C744 | 50 pf, tubular ceramic | " |
| C745 | 1000 pf, stand-off | " |
| C746 | 1000 pf, stand-off | " |
| C747 | 1000 pf, stand-off | 42 MC Amp., BA |
| C748 | 1000 pf, feed-thru | 60 MC Amp., BA |
| C749 | 50 pf, tubular ceramic | " |
| C750 | 1000 pf, stand-off | " |
| C751 | 1000 pf, stand-off | " |
| C752 | 1000 pf, stand-off | " |
| C754 | 1000 pf, stand-off | " |
| C755 | 50 pf, tubular ceramic | " |
| C757 | 1000 pf, stand-off | " |
| C758 | 1000 pf, stand-off | " |
| C759 | 1000 pf, stand-off | " |
| C760 | 1000 pf, stand-off | " |
| C761 | 10 pf, tubular ceramic | " |
| C762 | 50 pf, tubular ceramic | " |
| C763 | 1000 pf, feed-thru | " |
| C764 | 1000 pf, stand-off | " |
| C765 | 1000 pf, stand-off | 60 MC Preamp., BA |
| C766 | 1000 pf, stand-off | " |
| C767 | 1000 pf, stand-off | " |

II. CAPACITORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| C820 | .00147 mfd, 5% | Detector network, BA |
| C821 | 47 pf, 5% | " |
| C822 | 47 pf, 5% | " |
| C823 | .01 mfd | " |
| C824 | 47 pf, 5% | " |
| C825 | 1000 pf, feed-thru | " |
| C826 | 47 pf, 5% | " |
| C827 | .05 mfd, paper | " |
| C828 | 1000 pf, feed-thru | " |
| C829 | 1000 pf, feed-thru | " |
| C830 | 1000 pf, feed-thru | " |
| C831 | 1000 pf, feed-thru | " |
| C833 | 20 mfd, 15 V | Function sw., BA |
| C834 | 1000 pf, stand-off | 42 MC Amp., BA |
| C835 | 1000 pf, stand-off | " |
| C836 | .5 mfd, 200 V | Slideback, BA |
| C837 | .5 mfd, 200 V | Detector network, BA |
| C838 | .01 mfd | Audio chassis, BA |
| C839 | 500 pf, dura mica | " |
| C840 | 20 mfd, 15 V | " |
| C841 | 1000 pf, feed-thru | 60 MC Amp., BA |
| C842 | .01 mfd | Audio chassis, BA |
| C843 | 1000 pf, stand-off | " |
| C844 | 50 pf, tubular ceramic | 42 MC Amp., BA |
| C845 | 1000 pf, stand-off | " |
| C846 | 1000 pf, stand-off | " |
| C847 | 1000 pf, stand-off | " |
| C848 | 1000 pf, stand-off | " |
| C849 | 50 pf, tubular ceramic | " |
| C850 | 1000 pf, stand-off | " |
| C851 | 1000 pf, stand-off | " |
| C852 | 1000 pf, stand-off | " |
| C853 | 1000 pf, stand-off | " |
| C854 | 50 pf, tubular ceramic | 42 MC Amp., BA |
| C855 | 1000 pf, feed-thru | Transistor chassis, BA |
| C856 | .1 mfd | 60 MC Amp., BA |
| C857 | 1000 pf, stand-off | Transistor chassis, BA |
| C858 | 1000 pf, stand-off | " |
| C859 | 1000 pf, stand-off | " |
| C860 | 50 pf, tubular ceramic | " |
| C861 | 1000 pf, stand-off | " |
| C862 | 1000 pf, stand-off | " |
| C863 | 1000 pf, stand-off | " |
| C864 | 1000 pf, stand-off | " |
| C865 | 50 pf, tubular ceramic | " |
| C866 | 1000 pf, stand-off | " |
| C867 | 1000 pf, stand-off | " |
| C868 | 1000 pf, stand-off | " |

II. CAPACITORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| C869 | 4 mfd, 200 V | Audio chassis, BA |
| C870 | 50 pf, tubular ceramic | Transistor chassis, BA |
| C872 | 1000 pf, stand-off | " |
| C873 | 1000 pf, stand-off | " |
| C874 | 1000 pf, stand-off | " |
| C875 | 1000 pf, feed-thru | " |
| C876 | 1000 pf, stand-off | 42 MC Amp., BA |
| C877 | 1000 pf, stand-off | " |
| C878 | 1000 pf, stand-off | " |
| C879 | 1000 pf, stand-off | " |
| C880 | 1000 pf, stand-off | " |
| C881 | 1000 pf, feed-thru | " |
| C882 | 1000 pf, stand-off | " |
| C884 | 270 mfd | Bandwidth filter, BA |
| C885 | 82 pf, mica | " |
| C888 | 1000 pf, feed-thru | " |
| C889 | 82 pf, mica | " |
| C893 | 1000 pf, feed-thru | " |
| C894 | 56 pf, mica | 60 MC Preamp., BA |
| C897 | 1000 pf, feed-thru | Transistor chassis, BA |
| C898 | 1000 pf, feed-thru | " |
| C901 | 150 mfd | Impulse Gen., BA |
| C902 | 130 pf | 60 MC Preamp., BA |
| C903 | 1000 pf, feed-thru | " |
| C907 | 25 pf, tubular ceramic | " |
| C908 | 1 pf, tubular min. | " |
| C909 | 6.8 pf | " |
| C910 | 1000 pf, stand-off | Local osc., BA |
| C911 | 1000 pf, feed-thru | " |
| C912 | 1000 pf, feed-thru | " |
| C913 | 150 pf | " |
| C914 | 5 pf, tubular ceramic | " |
| C915 | 50 pf, tubular ceramic | " |
| C916 | 1000 pf, stand-off | " |
| C917 | 50 pf, tubular ceramic | " |
| C918 | 1000 pf, stand-off | " |
| C919 | 15 pf, tubular ceramic | " |
| C920 | Feed-thru | Local osc., BA |
| C921 | 1000 pf, feed-thru | " |
| C922 | 1000 pf, stand-off | " |
| C923 | 1000 pf, stand-off | " |
| C924 | 1000 pf, stand-off | " |
| C927 | 1000 pf, stand-off | AFC, BA |
| C929 | 1000 pf, stand-off | " |
| C930 | 1000 pf, feed-thru | 60 MC Preamp., BA |
| C931 | 1000 pf, stand-off | " |
| C932 | 1000 pf, stand-off | Bandwidth filter, BA |
| C933 | 65-320 pf | " |

II. CAPACITORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| C934 | 1000 pf, stand-off | 60 MC Preamp., BA |
| C935 | 540 pf | Bandwidth filter, BA |
| C936 | 1000 pf, stand-off | " |
| C937 | 1000 pf, stand-off | " |
| C938 | 1000 pf, feed-thru | Detector network, BA |
| C939 | 10 pf, tubular ceramic | " |
| C940 | .01 mfd | AFC, BA |
| C947 | 1000 pf, 1 KV | " |
| C948 | 1000 pf, 1 KV | " |
| C960 | 25 pf, tubular ceramic | 60 MC Preamp., BA |
| C961 | 1000 pf, stand-off | Local osc., BA |
| C962 | 1000 pf, feed-thru | Bandwidth filter, BA |
| C963 | 1000 pf, feed-thru | " |
| C964 | 1000 pf, feed-thru | 42 MC Amp., BA |
| C965 | 1000 pf, feed-thru | " |
| C966 | 1000 pf, 1 KV | AFC, BA |
| C967 | .05 mfd | Detector network, BA |
| C968 | .05 mfd | " |
| C969 | .05 mfd | " |
| C1101 | 4 mfd, 1000 V | Pwr. supply, BA |
| C1102 | .1 mfd, 400 V | " |
| C1103 | .5 mfd, 600 V | " |
| C1104 | 2 mfd, 600 V | " |
| C1105 | 4 mfd, 1500 V | " |
| C1106 | .1 mfd, 400 V | " |
| C1107 | .05 mfd, 600 V | " |
| C1108 | 1 mfd, 1000 V | " |
| C1109 | 1200 mfd, 25 V | " |
| C1110 | 150 mfd, 15 V | " |
| C1111 | 150 mfd, 15 V | " |
| C1112 | 75 mfd, 6 V | " |
| C1113 | 75 mfd, 6 V | " |
| C1114 A | 35 mfd, 400 V | " |
| C1114 B | 35 mfd, 400 V | " |
| C1115 | .05 mfd, paper | " |
| C1116 A | 35 mfd, 400 V | " |
| C1116 B | 35 mfd, 400 V | " |
| C1117 | .05 mfd, paper | " |
| C1118 | 6600 mfd, 15 V | " |
| C1119 | 2 mfd, paper | " |
| C1120 | .05 mfd, paper | " |
| C1121 | 200 pf, 1000 V | " |

III. CRYSTAL

| Ref. Symbol | Description | Part of |
|---|---|---|
| CR708 | 51 MC quartz | Local osc., BA |

IV. DIODES

| Ref. Symbol | Description | Part of |
|---|---|---|
| CR101 | SD-95 or CEC-500 | Klystron ckt., T1 |
| CR102 | SD-95 or CEC-500 | " |
| CR103 | MA421B | Preselector ckt., T1 |
| CR201 | SD-95 or CEC-500 | Klystron ckt., T2 |
| CR202 | SD-95 or CEC-500 | " |
| CR203 | MA421B | Preselector ckt., T2 |
| CR301 | SD-95 or CEC-500 | Klystron ckt., T3 |
| CR302 | SD-95 or CEC-500 | " |
| CR303 | 1N23E | Preselector ckt., T3 |
| CR304 | 1N289 | " |
| CR401 | SD-95 or CEC-500 | Klystron ckt., T4 |
| CR402 | SD-95 or CEC-500 | " |
| CR403 | 1N23E | Preselector ckt., T4 |
| CR702 | 1N21E | 60 MC Preamp., BA |
| CR703 | S6G or 1N813 | AFC, BA |
| CR704 | S6G or 1N813 | " |
| CR706 | S6G or 1N813 | Detector network, BA |
| CR707 | S6G or 1N813 | AFC, BA |
| CR710 | S6G or 1N813 | AFC, BA |
| CR1101 | CEC-1000 or A-40 | Pwr. supply, BA |
| CR1102 | CEC-1000 or A-40 | " |
| CR1103 | CEC-1000 or A-40 | " |
| CR1104 | CEC-1000 or A-40 | " |
| CR1105 | 1N2358 | " |
| CR1106 | 1N2358 | " |
| CR1107 | 1N2358 | " |
| CR1108 | 1N2358 | " |
| CR1109 | SD-95 or CEC-500 | " |
| CR1129 | TM4 or 1N206 or 1N2228 | " |
| CR1130 | TM4 or 1N206 or 1N2228 | " |
| CR1131 | 1N599 | " |
| CR1132 | 1N599 | " |
| CR1133 | 1N599 | " |
| CR1134 | 1N599 | " |
| CR1135 | 1N1508 | " |
| CR1136 | 1N1508 | " |
| CR1137 | SD-95 or CEC-500 | " |
| CR1138 | SD-95 or CEC-500 | " |
| CR1139 | SD-95 or CEC-500 | " |
| CR1140 | SD-95 or CEC-500 | " |
| CR1141 | SD-95 or CEC-500 | " |
| CR1142 | SD-95 or CEC-500 | " |
| CR1143 | SD-95 or CEC-500 | " |

IV. DIODES (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| CR1144 | SD-95 or CEC-500 | Pwr: supply, BA |
| CR1145 | 12F5 | " |
| CR1146 | 12F5 | " |
| CR1147 | 1N749 | " |
| CR1148 | 10Z6.3T5 | " |

V. DIAL LIGHTS

| Ref. Symbol | Description | Part of |
|---|---|---|
| DS1101 | #47 lamp | Pwr. supply, BA |
| DS1102 | #47 lamp | " |

VI. FUSES

| Ref. Symbol | Description | Part of |
|---|---|---|
| F1101 | 6 1/4 amp., slo-blo | Pwr. supply, BA |

VII. FILTERS

| Ref. Symbol | Description | Part of |
|---|---|---|
| FL101 | Filament filter | Klystron ckt., T1 |
| FL102 | Cathode filter | " |
| FL103 | Filament filter | " |
| FL104 | High pass filter | " |
| FL105 | Low pass filter | Preselector ckt., T1 |
| FL201 | Filament filter | Klystron ckt., T2 |
| FL202 | Cathode filter | " |
| FL203 | Filament filter | " |
| FL204 | Low pass filter | " |
| FL205 | Low pass filter | Preselector ckt., T2 |
| FL206 | Low pass filter | Mixer ckt., T2 |
| FL301 | Filament filter | Klystron ckt., T3 |
| FL302 | Cathode filter | " |
| FL303 | Filament filter | " |
| FL304 | Low pass filter | Mixer ckt., T3 |
| FL401 | Filament filter | Klystron ckt., T4 |
| FL402 | Cathode filter | " |
| FL403 | Filament filter | " |
| FL404 | Low pass filter | Mixer ckt., T4 |
| FL701 | Meter filter | Metering ckt., BA |
| FL750 | Meter filter | " |
| FL1101 | AC line filter | Pwr. supply, BA |
| FL1102 | Phone filter | " |
| FL1103 | Recorder filter | " |

## VIII. CONNECTORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| J101 | Connector, type N; UG-1095A/U | Sig. input, T1 |
| J201 | Connector, type N; UG-1095A/U | Sig. input, T2 |
| J301 | Connector, type N; UG-1095A/U | Sig. input, T3 |
| J401 | Connector, type N; UG-1095A/U | Sig. input, T4 |
| J701 | Connector, BNC, TRU-331 | 348 MC Preamp., BA |
| J702 | Connector, BNC, TRU-331 | " |
| J704 | Receptacle, type BNC; UG-625/U | 60 MC Preamp., BA |
| J705 | Receptacle, type BNC; UG-625/U | " |
| J706 | Receptacle, type BNC; UG-625/U | " |
| J707 | Receptacle, type BNC; UG-625/U | " |
| J708 | Receptacle, type BNC; UG-625/U | " |
| J709 | Receptacle, type BNC; UG-625/U | " |
| J710 | Receptacle, type BNC; UG-625/U | Local osc., BA |
| J711 | Receptacle, type BNC; UG-625/U | " |
| J712 | Receptacle, type BNC; UG-625/U | 42 MC IF, BA |
| J713 | Receptacle, type BNC; UG-625/U | " |
| J714 | Receptacle, audio | Audio Det., BA |
| J715 | Receptacle, type BNC; UG-625/U | 60 MC Amp., BA |
| J716 | Receptacle, type BNC; UG-625/U | AFC, BA |
| J730 | Socket, AFC | " |
| J741 | Receptacle, type BNC; UG-291/U | Front panel, BA |
| J742 | Connector, DPD-D15-33S-1A | Tuning unit cavity, BA |
| J743 | Connector, DPB-F16-33S-1A | " |
| J1103 | AC power connector | Pwr. supply, BA |
| J1104 | Phone jack | " |
| J1105 | External meter, recorder jack | " |
| P101A | Connector, C60400-1 | Pwr. source, T1 |
| P101B | Connector, C60400-3 | " |
| P201A | Connector, C60400-1 | Pwr. source, T2 |
| P201B | Connector, C60400-3 | " |
| P301A | Connector, C60400-1 | Pwr. source, T3 |
| P301B | Connector, C60400-3 | " |
| P401A | Connector, C60400-1 | Pwr. source, T4 |
| P401B | Connector, C60400-3 | " |
| P701 | Connector, type BNC; UG-88/U | 348 MC Preamp., BA |
| P702 | Connector, UG-88/U with adapter UG-306A/U | " |
| P710 | Connector, type BNC; UG-88/U | 51 MC Filter, BA |
| P711 | Connector, UG-88/U with adapter UG-306A/U | 60 MC Preamp., BA |
| P718 | Connector, UG-88/U with adapter UG-306A/U | Detector network, BA |
| P720 | Connector, type BNC; UG-88/U | 51 MC Filter, BA |
| P721 | Connector, UG-88/U with adapter UG-306A/U | 60 MC Preamp., BA |
| P722 | Connector, type BNC; UG-88/U | Bandwidth filter, BA |
| P726 | Connector, type BNC; UG-88/U | 60 MC Preamp., BA |
| P727 | Connector, type BNC; UG-88/U | 60 MC Amp., BA |
| P729 | Connector, type BNC; UG-88/U | " |

VIII. CONNECTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| P730 | 3 pin male, AFC | AFC, BA |
| P731 | MS-91237 | Sig. input, BA |
| P734 | Plug, audio | Detector network, BA |
| P736 | Connector , UG-88/U with adapter UG-306A/U | AFC, BA |
| P739 | Special, type N | To tuning unit, BA |
| P751 | Connector, type BNC; UG-88/U | 60 MC Amp., BA |

IX: RELAYS

| Ref. Symbol | Description | Part of |
|---|---|---|
| K702 | Relay, SPDT; 335 ohms | Impulse gen.; BA |
| K1101 | Relay, 3 PDT; 115 V AC-10 amps | Pwr. supply, BA |
| S1101 | Time delay relay | " |

X: INDUCTORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| L701 | Filter choke | 348 MC Preamp., BA |
| L702 | Filter choke | 60 MC Preamp., BA |
| L703 | Plate coil | " |
| L704 | Plate coil | " |
| L705 | Output coil | " |
| L707 | Filter choke | 348 MC Preamp., BA |
| L708 | Plate coil | " |
| L709 | RF choke | 60 MC Preamp., BA |
| L710 | RF choke | " |
| L711 | Input coil | 60 MC Amp., BA |
| L712 | Plate tuning coil | " |
| L713 | Plate tuning coil | " |
| L714 | Plate tuning coil | " |
| L715 | Plate tuning coil | " |
| L716 | Plate tuning coil | " |
| L717 | Plate tuning coil | Bandwidth filter, BA |
| L718 | Plate tuning coil | 60 MC Amp., BA |
| L719 | Oscillator tank coil | Local osc., BA |
| L720 | Plate tuning coil | " |
| L721 | Plate tuning coil | " |
| L722 | Input coil | 42 MC Amp., BA |
| L723 | Plate tuning coil | " |
| L724 | Plate tuning coil | " |
| L725 | Plate tuning coil | " |
| L726 | Plate tuning coil | " |
| L727 | Plate tuning coil | " |
| L728 | Plate tuning coil | " |

X. INDUCTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| L729 | Input coil | AFC, BA |
| L730 | Plate coil | " |
| L731 | Plate coil | " |
| L732 | Plate tuning coil | " |
| L733 | Plate tuning coil | " |
| L734 | Output coil | " |
| L735 | Filter coil | 51 MC Filter, BA |
| L736 | RF choke | Local osc., BA |
| L737 | Filament choke | 60 MC Preamp., BA |
| L738 | Filament choke | " |
| L740 | Filament choke, 3.3 uh | AFC, BA |
| L742 | Filament choke, 3.3 uh | 60 MC Amp., BA |
| L743 | Filament choke, 3.3 uh | " |
| L744 | Filament choke, 3.3 uh | " |
| L745 | Filament choke, 3.3 uh | " |
| L746 | Filament choke, 3.3 uh | " |
| L747 | Filament choke, 3.3 uh | " |
| L748 | Filament choke, 3.3 uh | AFC, BA |
| L750 | Filament choke, 3.3 uh | " |
| L751 | Filament coil | Detector network, BA |
| L752 | Filament coil | " |
| L753 | Filament choke, 3.3 uh | 42 MC Amp., BA |
| L754 | Filament choke, 3.3 uh | " |
| L755 | Filament choke, 3.3 uh | " |
| L756 | Filament choke, 3.3 uh | " |
| L757 | Filament choke, 3.3 uh | " |
| L758 | Filament choke, 3.3 uh | " |
| L759 | Input coil | Bandwidth filter, BA |
| L760 | Plate tuning coil | " |
| L764 | Filament choke, 3.3 uh | Local osc., BA |
| L765 | Filament choke, 3.3 uh | " |
| L766 | Filament choke, 3.3 uh | " |
| L767 | Filament choke, 3.3 uh | AFC, BA |
| L772 | Filter coil | 51 MC Filter, BA |
| L775 | RF choke | Transistor chassis, BA |
| L776 | Filament choke | 60 MC Preamp., BA |
| L777 | Filament choke | " |
| L778 | Filament choke | " |
| L779 | Filament choke 3.3 uh | Bandwidth filter, BA |

XI. METERS

| Ref. Symbol | Description | Part of |
|---|---|---|
| M701 | Meter, 100 uA; 0-40 DB scale | Indicating ckt., BA |

## XII. TRANSISTORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| Q701 | 2N169A | Transistor chassis, BA |
| Q702 | 2N242 | " |
| Q703 | 2N242 | " |
| Q741 | 2N242 | Impulse gen., BA |
| Q742 | 2N242 | " |
| Q1101A | 2N277 | Pwr. supply, BA |
| Q1101B | 2N277 | " |
| Q1101C | 2N277 | " |
| Q1102 | 2N242 | " |
| Q1103 | 2N1306 | " |
| Q1104 | 2N1306 | " |

## XIII. RESISTORS

| Ref. Symbol | Description | Part of |
|---|---|---|
| R101 | 15K ohms, ± 10%, 1/2W | Klystron ckt., T1 |
| R102 | 100K ohms, ± 10%, 1/2W | DC Amp. ckt., T1 |
| R103 | 100K ohms, ± 10%, 1/2W | " |
| R104 | 51K ohms, ± 10%, 1/2W | " |
| R105 | 2.2M, ± 10%, 1/2W | " |
| R106 | Potentiometer, 2.5K ohms, 2W | " |
| R107 | Potentiometer, 35K ohms | " |
| R108A | Potentiometer, precision linear, 50K ohms, 4W | " |
| R108B | Potentiometer, precision linear, 50K ohms, 4W | " |
| R109 | 47K ohms, ± 10%, 1/2W | " |
| R110 | 82K ohms, ± 10%, 1/2W | Xtal. current, T1 |
| R111 | Potentiometer, 250K ohms | " |
| R112 | 1K ohms, ± 10%, 1/2W | Preselector ckt., T1 |
| R201 | 15K ohms, ± 10%, 1/2W | Klystron ckt., T2 |
| R202 | 100K ohms, ± 10%, 1/2W | DC Amp. ckt., T2 |
| R203 | 100K ohms, ± 10%, 1/2W | " |
| R204 | 51K ohms, ± 10%, 1/2W | " |
| R205 | 2.2M, ± 10%, 1/2W | " |
| R206 | Potentiometer, 2.5K ohms, 2W | " |
| R207 | Potentiometer, 35K ohms | " |
| R208A | Potentiometer, precision linear, 50K ohms, 4W | " |
| R208B | Potentiometer, precision linear, 50K ohms, 4W | " |
| R209 | 47K ohms, ± 10%, 1/2W | DC Amp. ckt., T2 |
| R210 | 82K ohms, ± 10%, 1/2W | Xtal. current, T2 |
| R211 | Potentiometer, 250K ohms | " |
| R301 | 15K ohms, ± 10%, 1/2W | Klystron ckt., T3 |
| R302 | 100K ohms, ± 10%, 1/2W | DC Amp. ckt., T3 |
| R303 | 100K ohms, ± 10%, 1/2W | " |
| R304 | 51K ohms, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R305 | 2.2M, ± 10%, 1/2W | DC Amp. ckt., T3 |
| R306 | Potentiometer, 2.5K ohms, 2W | " |
| R307 | Potentiometer, 35K ohms | " |
| R308A | Potentiometer, precision linear, 50K ohms, 4W | " |
| R308B | Potentiometer, precision linear, 50K ohms, 4W | " |
| R309 | 47K ohms, ± 10%, 1/2W | " |
| R310 | Potentiometer, 2.5K ohms, 2W | Xtal. current, T3 |
| R311 | 75K ohms, ± 5%, 2W | Repeller voltage divider |
| R401 | 15K ohms, ± 10%, 1/2W | Klystron ckt., T4 |
| R402 | 100K ohms, ± 10%, 1/2W | DC Amp. ckt., T4 |
| R403 | 100K ohms, ± 10%, 1/2W | " |
| R404 | 51K ohms, ± 10%, 1/2W | " |
| R405 | 2.2M, ± 10%, 1/2W | " |
| R406 | Potentiometer, 2.5K ohms, 2W | " |
| R407 | Potentiometer, 35K ohms | " |
| R408A | Potentiometer, precision linear, 50K ohms, 4W | " |
| R408B | Potentiometer, precision linear, 50K ohms, 4W | " |
| R409 | 68K ohms, ± 10%, 1/2W | " |
| R410 | Potentiometer, 2.5K ohms, 2W | Xtal. current, T4 |
| R411 | Potentiometer, 10K ohms | " |
| R412 | Potentiometer, 43K ohms, 2W | " |
| R413 | 68K ohms, ± 10%, 1/2W | DC Amp. ckt., T4 |
| R701 | 18 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R702 | 68 ohms, ± 10%, 1/2W | 60 MC Preamp., BA |
| R703 | 68 ohms, ± 10%, 1/2W | " |
| R704 | 150 ohms, ± 10%, 1/2W | " |
| R706 | 680 ohms, ± 10%, 1/2W | " |
| R707 | 150 ohms, ± 10%, 1/2W | " |
| R708 | 220 ohms, ± 10%, 1/2W | " |
| R709 | 1K ohms, ± 10%, 1/2W | " |
| R710 | 1K ohms, ± 10%, 1/2W | " |
| R711 | 150 ohms, ± 10%, 1/2W | " |
| R712 | 1.2K ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R713 | 100K ohms, ± 10%, 1/2W | " |
| R714 | 150 ohms, ± 10%, 1/2W | " |
| R715 | 1.5K ohms, ± 10%, 1/2W | " |
| R716 | 100K ohms, ± 10%, 1/2W | " |
| R717 | 1.2K ohms, ± 10%, 1/2W | " |
| R718 | 150 ohms, ± 10%, 1/2W | " |
| R719 | 150 ohms, ±10%, 1/2W | " |
| R720 | 1.5K ohms, ± 10%, 1/2W | " |
| R721 | 100K ohms, ± 10%, 1/2W | " |
| R722 | 1.2K ohms, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R723 | 150 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R724 | 150 ohms, ± 10%, 1/2W | " |
| R725 | 1.5K ohms, ± 10%, 1/2W | " |
| R726 | 150 ohms, ± 10%, 1/2W | " |
| R727 | 1.2K ohms, ± 10%, 1/2W | " |
| R728 | 1K ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R729 | 1.5K ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R730 | 150 ohms, ± 10%, 1/2W | " |
| R731 | 1.2K ohms, ± 10%, 1/2W | " |
| R732 | 150 ohms, ± 10%, 1/2W | " |
| R733 | 1.5K ohms, ± 10%, 1/2W | " |
| R734 | 1.2K ohms, ± 10%, 1/2W | " |
| R735 | 150 ohms, ± 10%, 1/2W | " |
| R736 | 100 ohms, ± 10%, 1/2W | " |
| R737 | 1K ohms, ± 10%, 1/2W | " |
| R738 | 150 ohms, ± 10%, 1/2W | " |
| R739 | 18 ohms, ± 10%, 1/2W | " |
| R740 | 150 ohms, ± 10%, 1/2W | AFC, BA |
| R741 | 150 ohms, ± 10%, 1/2W | " |
| R742 | 3.9K ohms, ± 10%, 1/2W | " |
| R743 | 18 ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R744 | 150 ohms, ± 10%, 1/2W | AFC, BA |
| R745 | 150 ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R746 | 150 ohms, ± 10%, 1/2W | AFC, BA |
| R747 | 3.9K ohms, ± 10%, 1/2W | " |
| R748 | 150 ohms, ± 10%, 1/2W | " |
| R749 | 15K ohms, ± 10%, 1/2W | " |
| R750 | 18K ohms, ± 10%, 1/2W | " |
| R751 | 1.2K ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R752 | 150 ohms, ± 10%, 1/2W | AFC, BA |
| R753 | 150 ohms, ± 10%, 1/2W | " |
| R754 | 15K ohms, ± 10%, 1/2W | " |
| R755 | 270 ohms, ± 10%, 1/2W | " |
| R756 | 150 ohms, ± 10%, 1/2W | " |
| R757 | 150 ohms, ± 10%, 1/2W | " |
| R758 | 100K ohms, ± 10%, 1/2W | " |
| R759 | 100K ohms, ± 10%, 1/2W | " |
| R760 | 1.2K ohms, ± 10%, 1/2W | Detector network, BA |
| R762 | 33K ohms, ± 10%, 1/2W | " |
| R763 | 33K ohms, ± 10%, 1/2W | " |
| R764 | 20K ohms, ± 1%, 1/2W | " |
| R765 | 22K ohms, ± 1%, 1/2W | " |
| R766 | 470K ohms, ± 10%, 1/2W | " |
| R767 | 470 ohms, ± 10%, 1/2W | " |
| R768 | 390 ohms, ± 10%, 1/2W | " |
| R769 | 15K ohms, ± 10%, 1/2W | " |
| R770 | 560 ohms, ± 10%, 1/2W | " |
| R771 | 470 ohms, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R772 | 470K ohms, ± 10%, 1/2W | Detector network, BA |
| R773 | 100 ohms, ± 10%, 1/2W | " |
| R774 | 68K ohms, ± 5%, 2W | " |
| R775 | 10K ohms, ± 5%, 2W | " |
| R776 | 10K ohms, ± 5%, 2W | " |
| R777 | 68K ohms, ± 5%, 2W | " |
| R778 | 82 ohms, ± 10%, 1/2W | " |
| R779 | 2KM, ± 5%, 1/2W | " |
| R780 | 20KM, ± 5%, 1/2W | " |
| R781 | 20KM, ± 5%, 1/2W | " |
| R782 | Potentiometer, 5K ohms | " |
| R783 | 1.2K ohms, ± 10%, 1/2W | " |
| R784 | 200K ohms, ± 1%, 1/2W | " |
| R785 | 150K ohms, ± 5%, 1/2W | " |
| R786 | 150K ohms, ± 5%, 1/2W | " |
| R787 | 1.2M, ± 10%, 1/2W | " |
| R788 | 1.2M, ± 10%, 1/2W | " |
| R789 | Potentiometer, 2.5K ohms, zero adj. | " |
| R790 | 270 ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R791 | Potentiometer, 25K ohms, gain | Detector network, BA |
| R792 | 100K ohms, ± 10%, 1/2W | " |
| R794 | 150K ohms, ± 10%, 1/2W | " |
| R795 | Potentiometer, 25K ohms, slideback | " |
| R796 | Potentiometer, 250K ohms, volume | " |
| R797 | 150K ohms, ± 10%, 1/2W | " |
| R798 | 100K ohms, ± 10%, 1/2W | " |
| R799 | 78K ohms, ± 1%, 1/2W | " |
| R800 | 100K ohms, ± 10%, 1/2W | Audio chassis, BA |
| R801 | 1K ohms, ± 10%, 1/2W | " |
| R802 | 100K ohms, ± 10%, 1/2W | " |
| R803 | 470K ohms, ± 10%, 1/2W | " |
| R804 | 270 ohms, ± 10%, 1/2W | " |
| R805 | 10K ohms, ± 10%, 1/2W | " |
| R807 | 3.3 ohms, ± 10%, 1/2W wire wound | Detector network, BA |
| R808 | 1.5K ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R809 | 1K ohms, ± 10%, 1/2W | " |
| R810 | 150 ohms, ± 10%, 1/2W | " |
| R811 | 270 ohms, ± 10%, 1/2W | " |
| R812 | 1.5K ohms, ± 10%, 1/2W | " |
| R813 | 1K ohms, ± 10%, 1/2W | " |
| R814 | 150 ohms, ± 10%, 1/2W | " |
| R815 | 270 ohms, ± 10%, 1/2W | " |
| R816 | 1.5K ohms, ± 10%, 1/2W | " |
| R817 | 10 ohms, ± 10%, 1/2W | " |
| R818 | 150 ohms, ± 10%, 1/2W | " |
| R819 | 270 ohms, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R820 | 1.5K ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R821 | 150 ohms, ± 10%, 1/2W | " |
| R822 | 1K ohms, ± 10%, 1/2W | " |
| R823 | 270 ohms, ± 10%, 1/2W | " |
| R824 | 100 ohms, ± 10%, 1/2W | " |
| R825 | 68 ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R826 | 150 ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R827 | 47 ohms, ± 10%, 1/2W | " |
| R828 | 1.5K ohms, ± 10%, 1/2W | " |
| R829 | 47 ohms, ± 10%, 1/2W | " |
| R832 | 2KM, ± 5%, 1/2W | Detector network, BA |
| R833 | 100K ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R834 | 10 ohms, ± 10%, 1/2W | " |
| R835 | 10 ohms, ± 10%, 1/2W | " |
| R836 | 39.81K ohms, ± 1%, 1/2W | Impulse gen. attn., BA |
| R837 | 4.86K ohms, ± 1%, 1/2W | " |
| R838 | 5.45K ohms, ± 1%, 1/2W | " |
| R839 | 6.11K ohms, ± 1%, 1/2W | " |
| R840 | 6.87K ohms, ± 1%, 1/2W | " |
| R841 | 7.69K ohms, ± 1%, 1/2W | " |
| R842 | 8.64K ohms, ± 1%, 1/2W | " |
| R843 | 9.70K ohms, ± 1%, 1/2W | " |
| R844 | 10.87K ohms, ± 1%, 1/2W | " |
| R845 | 11.22K ohms, ± 1%, 1/2W | " |
| R846 | 13.7K ohms, ± 1%, 1/2W | " |
| R847 | 15.4K ohms, ± 1%, 1/2W | " |
| R848 | 10 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R849 | 68 ohms, ± 10%, 1/2W | 60 MC Preamp., BA |
| R850 | 100 ohms, ± 10%, 1/2W | " |
| R851 | 1.2K ohms, ± 10%, 1/2W | Transistor chassis, BA |
| R852 | 47 ohms, ± 10%, 1/2W | " |
| R853 | 4.7K ohms, ± 10%, 1/2W | " |
| R854 | 3.3K ohms, ± 10%, 1/2W | " |
| R855 | 100M, +100%, 1/2W -30% (A 10664) | Impulse gen., BA |
| R856 | 220 ohms, ± 10%, 1/2W | " |
| R857 | 220 ohms, ± 10%, 1/2W | Transistor chassis, BA |
| R858 | 24.2 ohms, ± 1%, 1/2W | IF atten., BA |
| R859 | 36 ohms, ± 1%, 1/2W | " |
| R860 | 120 ohms, ± 1%, 1/2W | " |
| R861 | 24.2 ohms, ± 1%, 1/2W | " |
| R862 | 36 ohms, ± 1%, 1/2W | " |
| R863 | Potentiometer, 25K ohms | 348 MC Preamp., BA |
| R864 | 10 ohms, ± 10%, 1/2W | Local osc., BA |
| R865 | 100 ohms, ± 10%, 1/2W | " |
| R866 | 390 ohms, ± 10%, 1/2W | " |
| R867 | 4.7K ohms, ± 10%, 1/2W | " |
| R868 | 4.7K ohms, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R869 | 4.7K ohms, ± 10%, 1/2W | Local osc., BA |
| R870 | 100 ohms, ± 10%, 1/2W | " |
| R871 | 10 ohms, ± 10%, 1/2W | Impulse gen., BA |
| R872 | 150 ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R873 | 100K ohms, ± 10%, 1/2W | " |
| R874 | 15K ohms, ± 1%, 1/2W | Detector network, BA |
| R875 | 18 ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R876 | 27K ohms, ± 10%, 1/2W | AFC, BA |
| R877 | 150 ohms, ± 10%, 1/2W | " |
| R880 | 27K ohms, ± 10%, 1/2W | " |
| R881 | 33K ohms, ± 10%, 1/2W | " |
| R882 | 33K ohms, ± 10%, 1/2W | " |
| R883 | 33K ohms, ± 10%, 1/2W | " |
| R885 | 68 ohms, ± 10%, 1/2W | " |
| R886 | 18 ohms, ± 10%, 1/2W | " |
| R887 | 18 ohms, ± 10%, 1/2W | " |
| R888 | 150 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R890 | 1K ohms, ± 10%, 1/2W | 60 MC Preamp., BA |
| R891 | 10 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R892 | 100 ohms, ± 10%, 1/2W | Bandwidth filter, BA |
| R894 | 18 ohms, ± 10%, 1/2W | 60 MC Amp., BA |
| R895 | 18 ohms, ± 10%, 1/2W | " |
| R896 | 10 ohms, ± 10%, 1/2W | " |
| R897 | 47 ohms, ± 10%, 1/2W | " |
| R898 | 18 ohms, ± 10%, 1/2W | 42 MC Amp., BA |
| R899 | 18 ohms, ± 10%, 1/2W | " |
| R900 | 18 ohms, ± 10%, 1/2W | " |
| R901 | 1K ohms, ± 10%, 1/2W | " |
| R902 | 390 ohms, ± 10%, 1/2W | " |
| R907 | 27K ohms, ± 10%, 1/2W | Detector network, BA |
| R1101 | 1.2K ohms, ± 10%, 1/2W | Pwr. supply, BA |
| R1102 | 220K ohms, ± 10%, 1/2W | " |
| R1103 | 470K ohms, ± 10%, 1/2W | " |
| R1104 | 2.2M, ± 10%, 1/2W | " |
| R1105 | 33K ohms, ± 10%, 2W | " |
| R1106 | 33K ohms, ± 10%, 2W | " |
| R1107 | 470K ohms, ± 10%, 1/2W | " |
| R1108 | 20K ohms, ± 10%, 5W | " |
| R1109 | 100K ohms, ± 1%, 1/2W | " |
| R1110 | Potentiometer, 50K ohms, 2W | " |
| R1111 | 100K ohms, ± 1%, 1/2W | " |
| R1112 | 1.2K ohms, ± 10%, 5W | " |
| R1113 | 10K ohms, ± 10%, 1/2W | " |
| R1114 | 1.2K ohms, ± 10%, 1/2W | " |
| R1115 | 220K ohms, ± 10%, 1/2W | " |
| R1116 | 470K ohms, ± 10%, 1/2W | " |
| R1117 | 33K ohms, ± 10%, 2W | " |
| R1118 | 2.2M, ± 10%, 1/2W | " |

XIII. RESISTORS (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| R1119 | 33K ohms, ± 10%, 2W | Pwr. supply, BA |
| R1120 | 470K ohms, ± 10%, 1/2W | " |
| R1121 | 50K ohms, ± 10%, 10W | " |
| R1122 | 100K ohms, ± 1%, 1/2W | " |
| R1123 | Potentiometer, 50K ohms, 2W | " |
| R1124 | 200K ohms, ± 1%, 1/2W | " |
| R1125 | 150K ohms, ± 1%, 1/2W | " |
| R1126 | 10 ohms, ± 10%, 20W | " |
| R1127 | 150 ohms, ± 10%, 1W | " |
| R1128 | Potentiometer, 500 ohms, ± 10%, 2W | " |
| R1129 | 150 ohms, ± 10%, 1W | " |
| R1130 | Potentiometer, 500 ohms, ± 10%, 2W | " |
| R1131 | 39K ohms, ± 10%, 2W | " |
| R1132A | 1.2K ohms, ± 10%, 1/2W | " |
| R1132B | 1.2K ohms, ± 10%, 1/2W | " |
| R1132C | 1.2K ohms, ± 10%, 1/2W | " |
| R1132D | 1.2K ohms, ± 10%, 1/2W | " |
| R1132E | 1.2K ohms, ± 10%, 1/2W | " |
| R1132F | 1.2K ohms, ± 10%, 1/2W | " |
| R1133A | 27 ohms, ± 10%, 1W | " |
| R1133B | 27 ohms, ± 10%, 1W | " |
| R1133C | 27 ohms, ± 10%, 1W | " |
| R1133D | 27 ohms, ± 10%, 1W | " |
| R1133E | 27 ohms, ± 10%, 1W | " |
| R1133F | 27 ohms, ± 10%, 1W | " |
| R1134 | 68K ohms, ± 10%, 1/2W | " |
| R1135 | 1.2K ohms, ± 10%, 1/2W | " |
| R1136 | 27K ohms, ± 10%, 2W | " |
| R1137 | 470K ohms, ± 10%, 1/2W | " |
| R1138 | 30K ohms, ± 10%, 5W | " |
| R1139 | 15K ohms, ± 10%, 5W | " |
| R1140 | 30K ohms, ± 10%, 5W | " |
| R1141 | Potentiometer, 25K ohms, 2W | " |
| R1142 | 27K ohms, ± 10%, 2W | " |
| R1143 | 100K ohms, ± 10%, 1/2W | " |
| R1144 | 470K ohms, ± 10%, 1/2W | " |
| R1145 | 1.2K ohms, ± 10%, 1/2W | " |
| R1146 | 27K ohms, ± 10%, 1W | " |
| R1147 | 1.2K ohms, ± 10%, 1/2W | " |
| R1148 | 470K ohms, ± 10%, 1/2W | " |
| R1149 | 30K ohms, ± 10%, 5W | " |
| R1150 | 30K ohms, ± 10%, 5W | " |
| R1151 | Potentiometer, 25K ohms, 2W | " |
| R1152 | 75 ohms, ± 10%, 5W | " |
| R1153A | .5 ohms, ± 10%, 2W | " |
| R1153B | .5 ohms, ± 10%, 2W | " |
| R1153C | .5 ohms, ± 10%, 2W | " |
| R1154 | 150 ohms, ± 10%, 1/2W | " |
| R1155 | 470 ohms, ± 10%, 1/2W | " |
| R1156 | Potentiometer, 50 ohms, 2W | " |
| R1157 | 47 ohms, ± 10%, 1/2W | " |
| R1160 | 3.3K ohms, ± 10%, 2W | " |

## XIV. SWITCHES

| Ref. Symbol | Description | Part of |
|---|---|---|
| S101 | Switch, wafer; 3 pole, 2 position | AFC ckt., T1 |
| S201 | Switch, wafer; 3 pole, 2 position | AFC ckt., T2 |
| S301 | Switch, wafer; 3 pole, 2 position | AFC ckt., T3 |
| S401 | Switch, wafer; 3 pole, 2 position | AFC ckt., T4 |
| S701 | Switch, wafer; 8 pole, 4 position | Function sw., BA |
| S702 | Switch, coaxial; 2 pole | Read-cal. sw., BA |
| S703 | Switch, wafer; 2 pole, 6 position | Bandwidth sw., BA |
| S704 | Switch, wafer; 2 pole, 6 position | Impulse gen., BA |
| S705 | Switch, wafer; 4 pole, 12 position | Impulse gen. atten., BA |
| S707 | Switch, wafer; 2 pole, 12 position | IF atten., BA |
| S1101 | 3 pole, 3 position, power | Pwr. supply, BA |

## XV. TRANSFORMERS

| Ref. Symbol | Description | Part of |
|---|---|---|
| T701 | Impulse gen. output transformer | Transistor chassis, BA |
| T727 | Audio Transformer | Audio chassis, BA |
| T1101 | Power Transformer | Pwr. supply, BA |
| T1102 | Power transformer (beam) | " |

## XVI. TERMINAL BOARDS

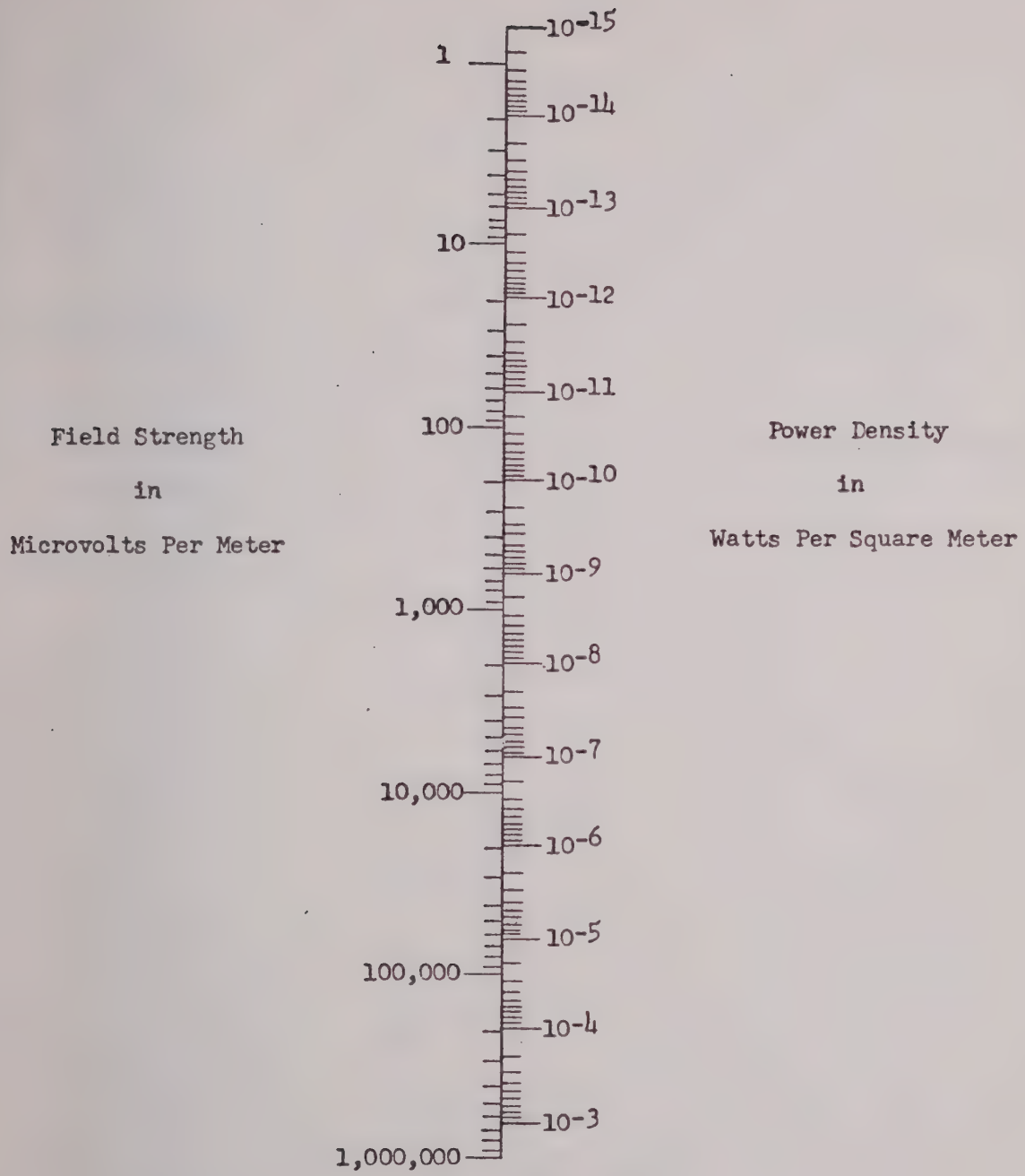
| Ref. Symbol | Description | Part of |
|---|---|---|
| TB701A | Terminal block, molded bakelite, 11 term. | Pwr. input, BA |
| TB701B | Terminal block, molded bakelite, 11 term. | " |
| TB727 | Terminal Block, porcelain, 6 term. | Audio ckt., BA |
| TB728 | Terminal block, porcelain, 6 term. | " |
| TB1101 | Terminal block, molded bakelite, 16 term. | Pwr. supply, BA |
| TB1102 | Terminal block, molded bakelite, 16 term. | " |

## XVII. TEST JACKS

| Ref. Symbol | Description | Part of |
|---|---|---|
| TP101 | Test jack, yellow; nylon | Klystron ckt., T1 |
| TP102 | Test jack, orange; nylon | " |
| TP103 | Test jack, orange; nylon | " |
| TP201 | Test jack, yellow; nylon | Klystron ckt., T2 |
| TP202 | Test jack, orange; nylon | " |
| TP203 | Test jack, orange; nylon | " |
| TP301 | Test jack, yellow; nylon | Klystron ckt., T3 |
| TP302 | Test jack, orange; nylon | " |
| TP303 | Test jack, orange; nylon | " |
| TP401 | Test jack, yellow; nylon | Klystron ckt., T4 |
| TP402 | Test jack, orange; nylon | " |
| TP403 | Test jack, orange; nylon | " |

XVIII. TUBES (continued)

| Ref. Symbol | Description | Part of |
|---|---|---|
| V1101 | 6CA7 or 7591 (pins differ) | Pwr. supply, BA |
| V1102 | 12AX7 | " |
| V1103 | 0A2 | " |
| V1104 | 6CA7 or 7591 (pins differ) | " |
| V1105 | 12AX7 | " |
| V1106 | 0A2 | " |
| V1107A | 6080 | " |
| V1107B | 6080 | " |
| V1107C | 6080 | " |
| V1108 | 6AK5 | " |
| V1109 | 6AQ5 | " |
| V1110 | 6AK5 | " |
| V1111 | 5651 | " |




CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

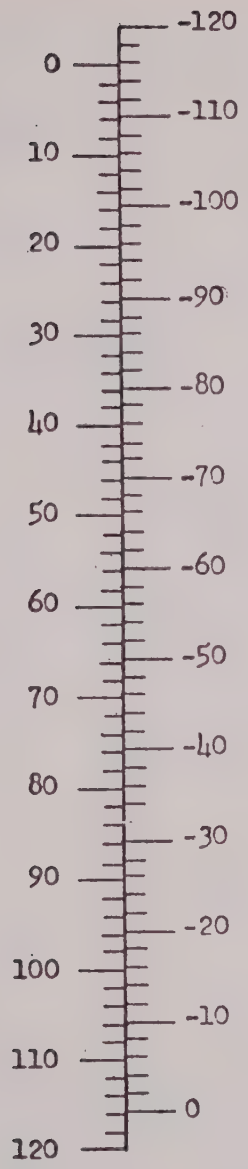
-- Microvolts Per Meter to Watts Per Square Meter

Field Strength

in

DB Above 1 Microvolt

Per Meter




Power Density

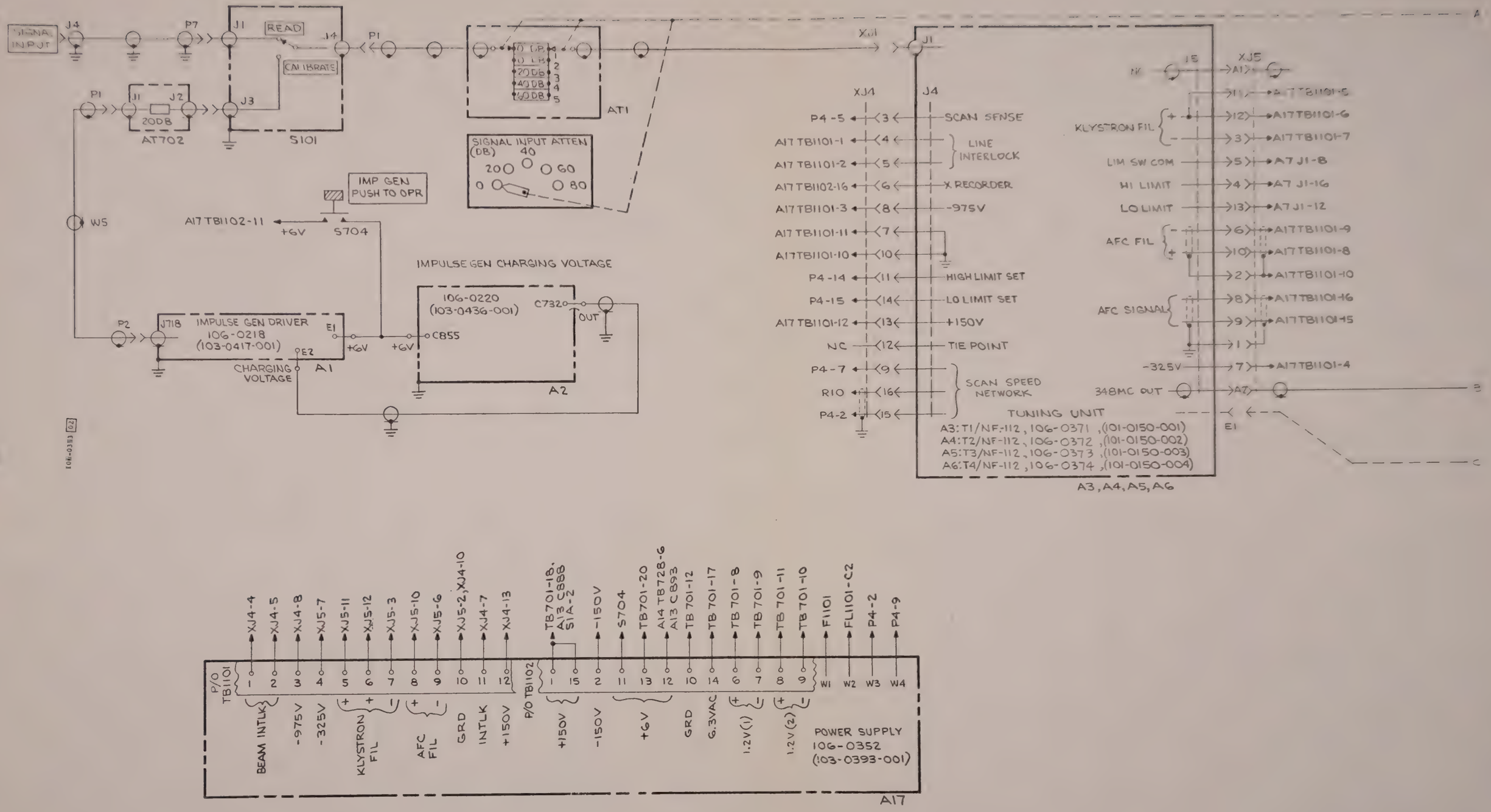
in

DBM Per Square Meter

CONVERSION CHART

FIELD STRENGTH to POWER DENSITY

-- DB Above 1 Microvolt Per Meter to DBM Per Square Meter

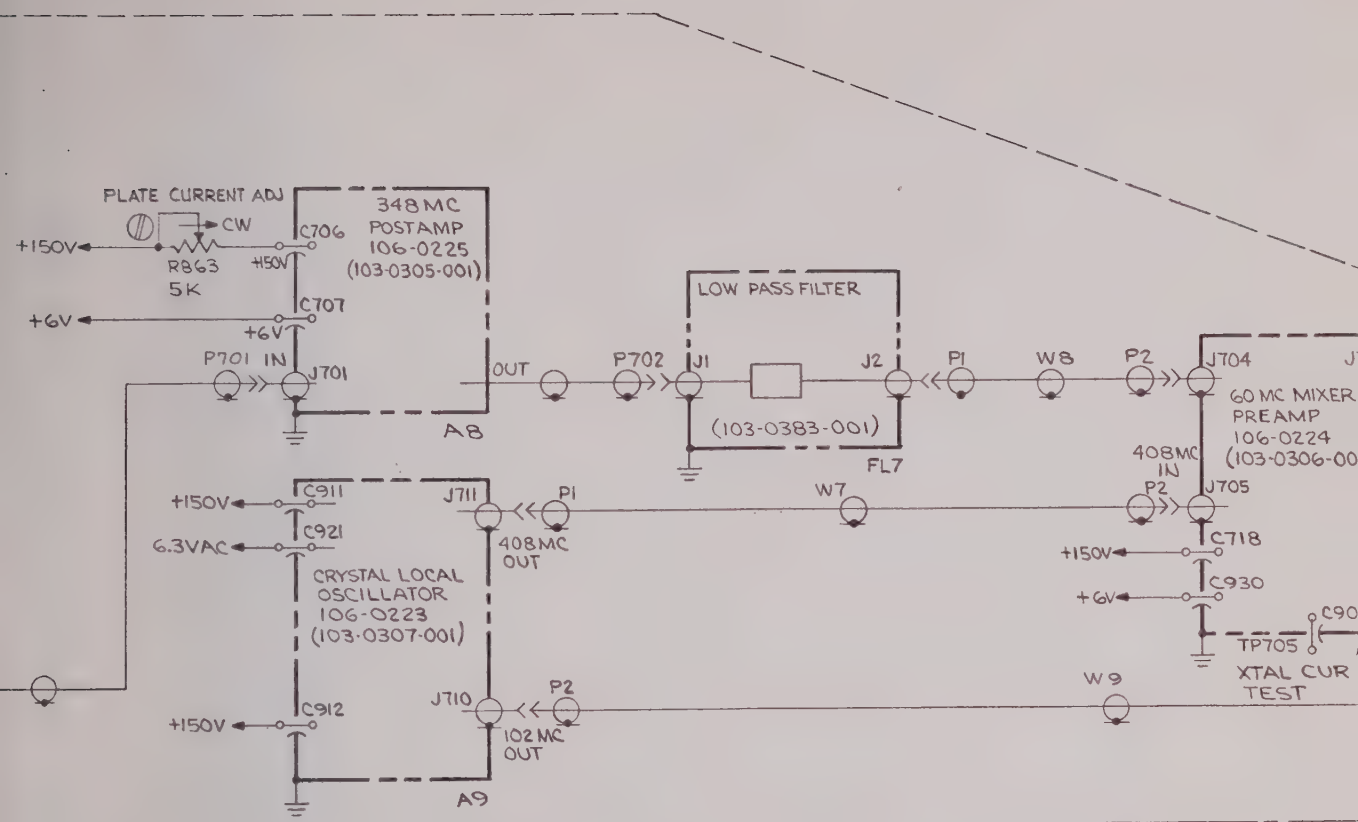


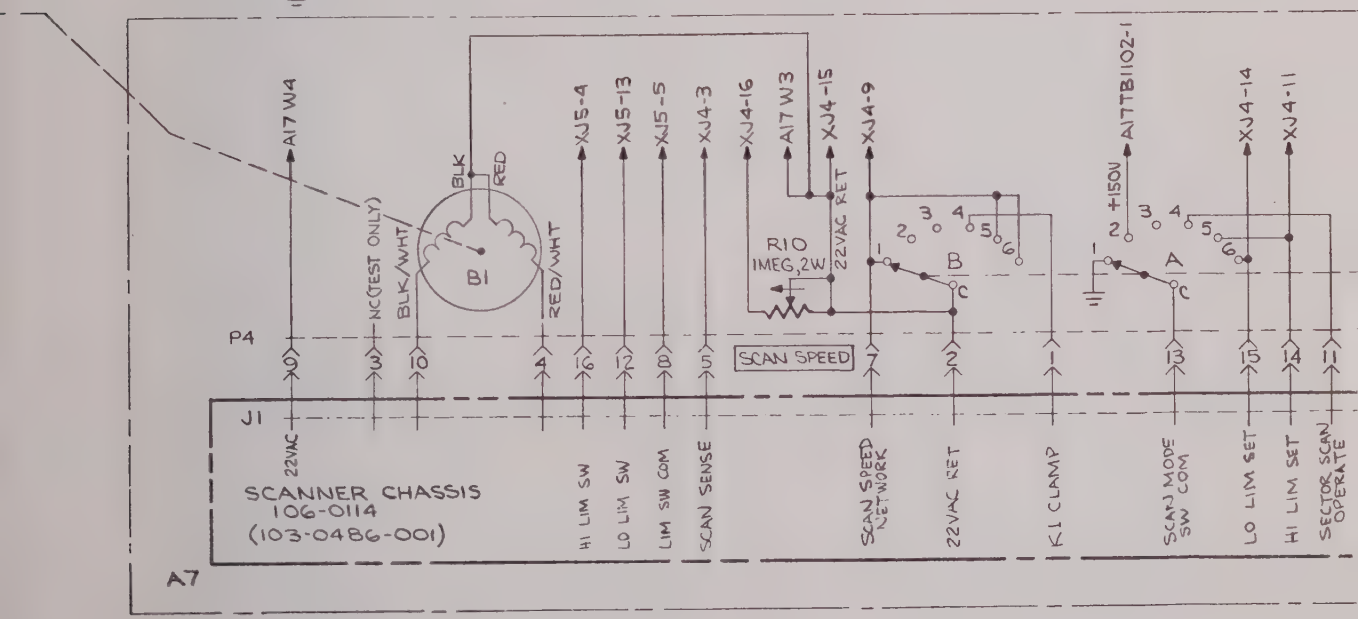




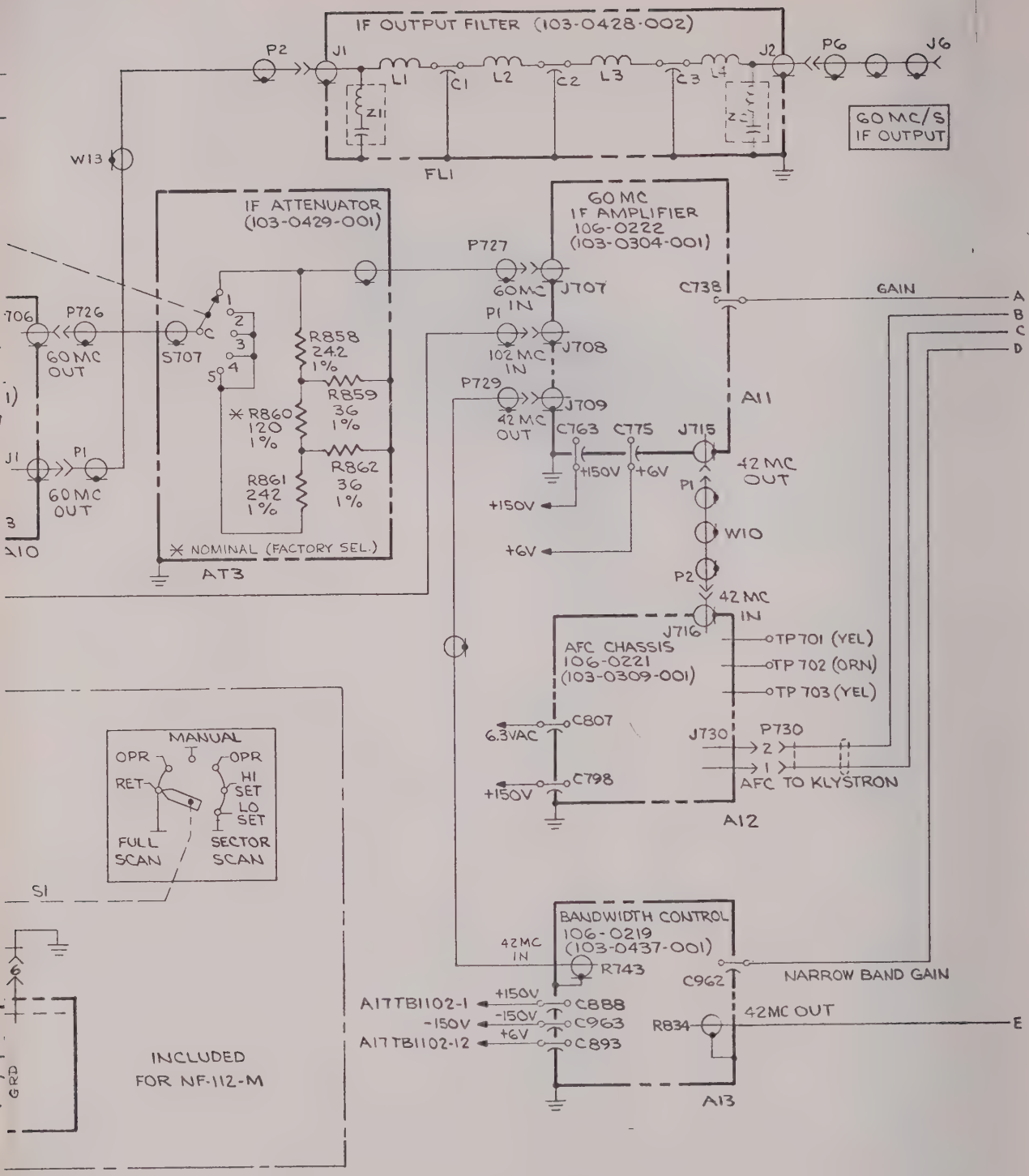
NOTES UNLESS OTHERWISE SPECIFIED

Schematic Diagram, Interconnecting Circuitry (Sheet 1 of 3)

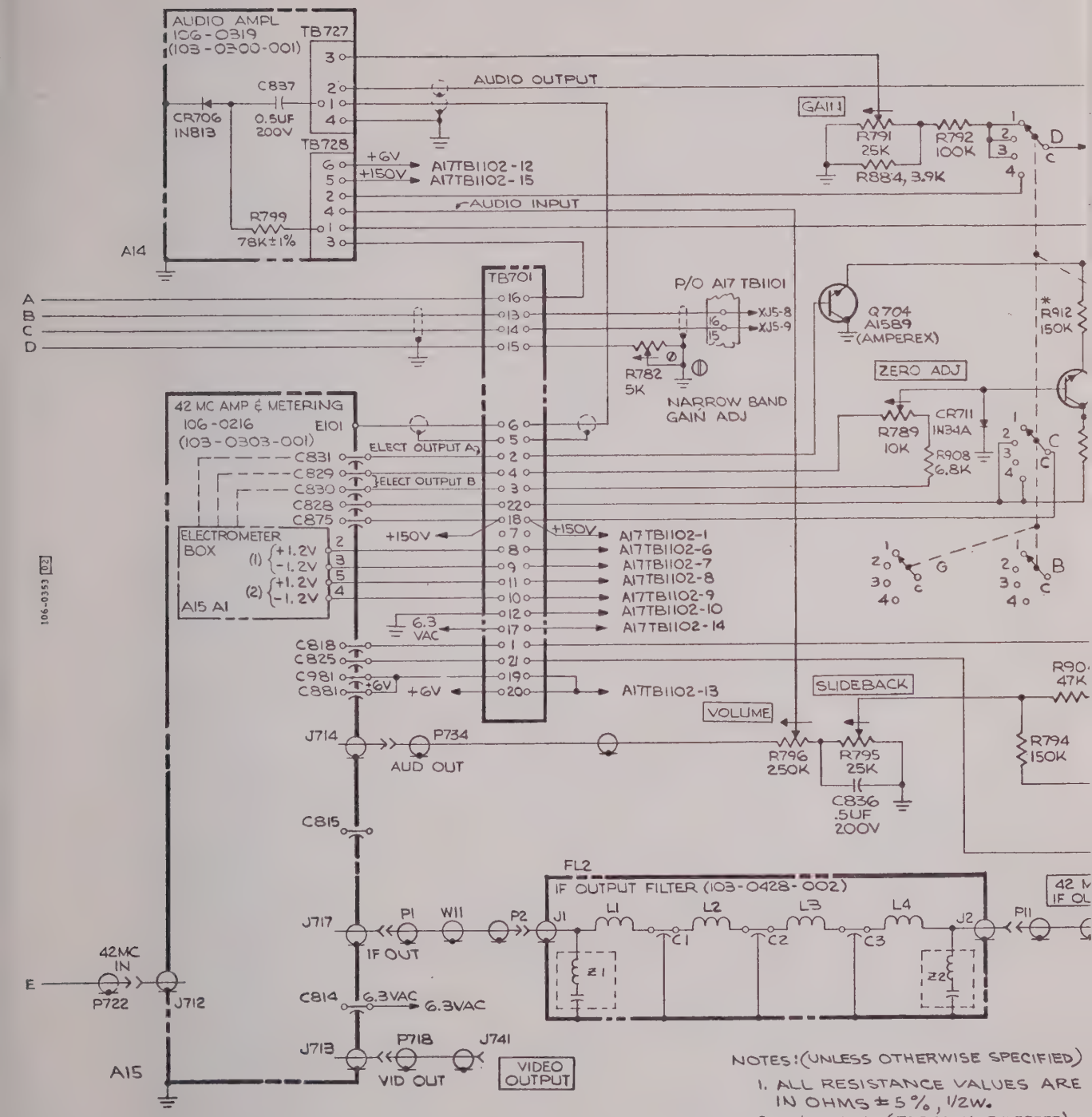



OTHERWISE SPECIFIED



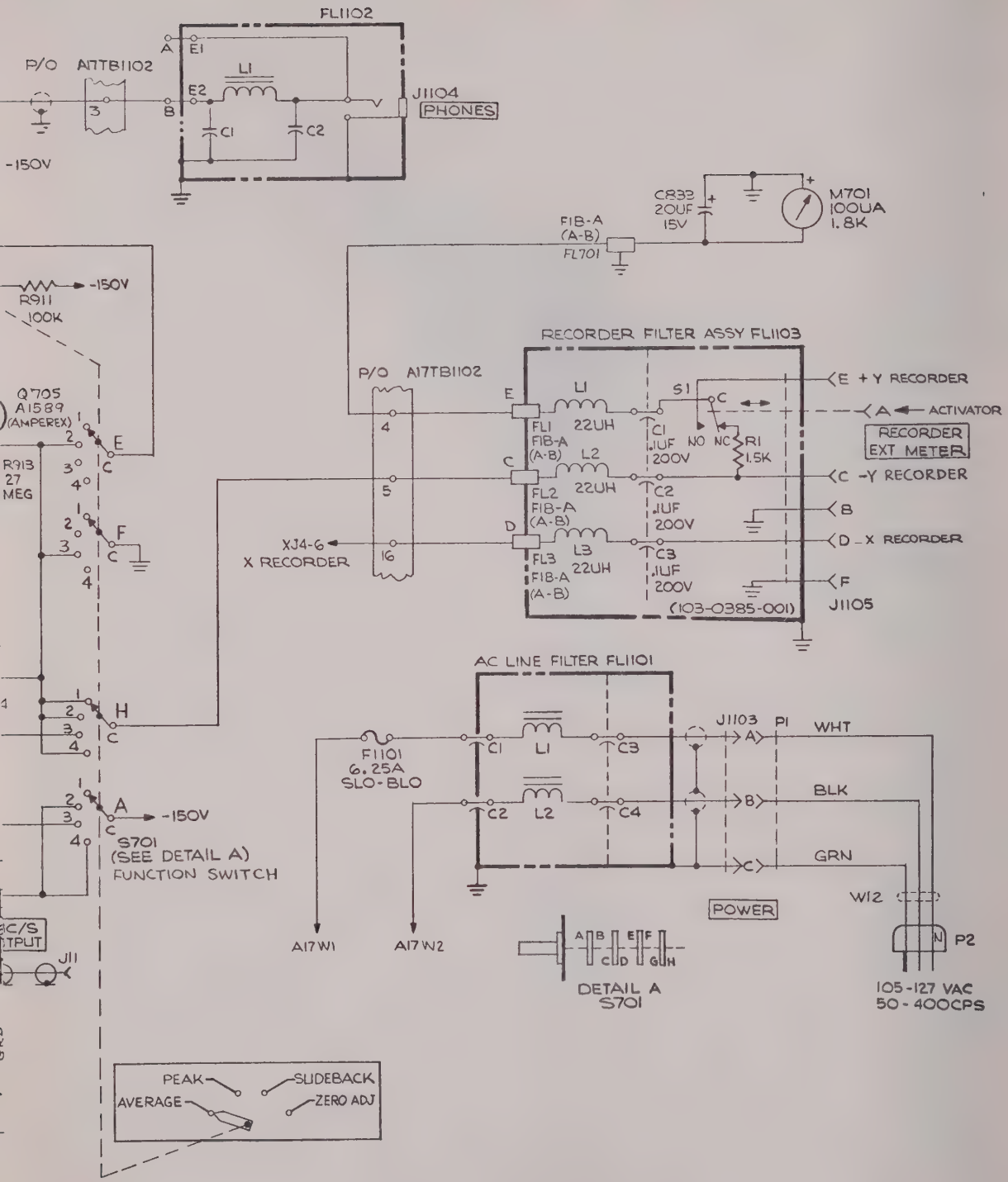

Schematic Diagram, Interconnecting Circuitry (Sheet 2 of 3)



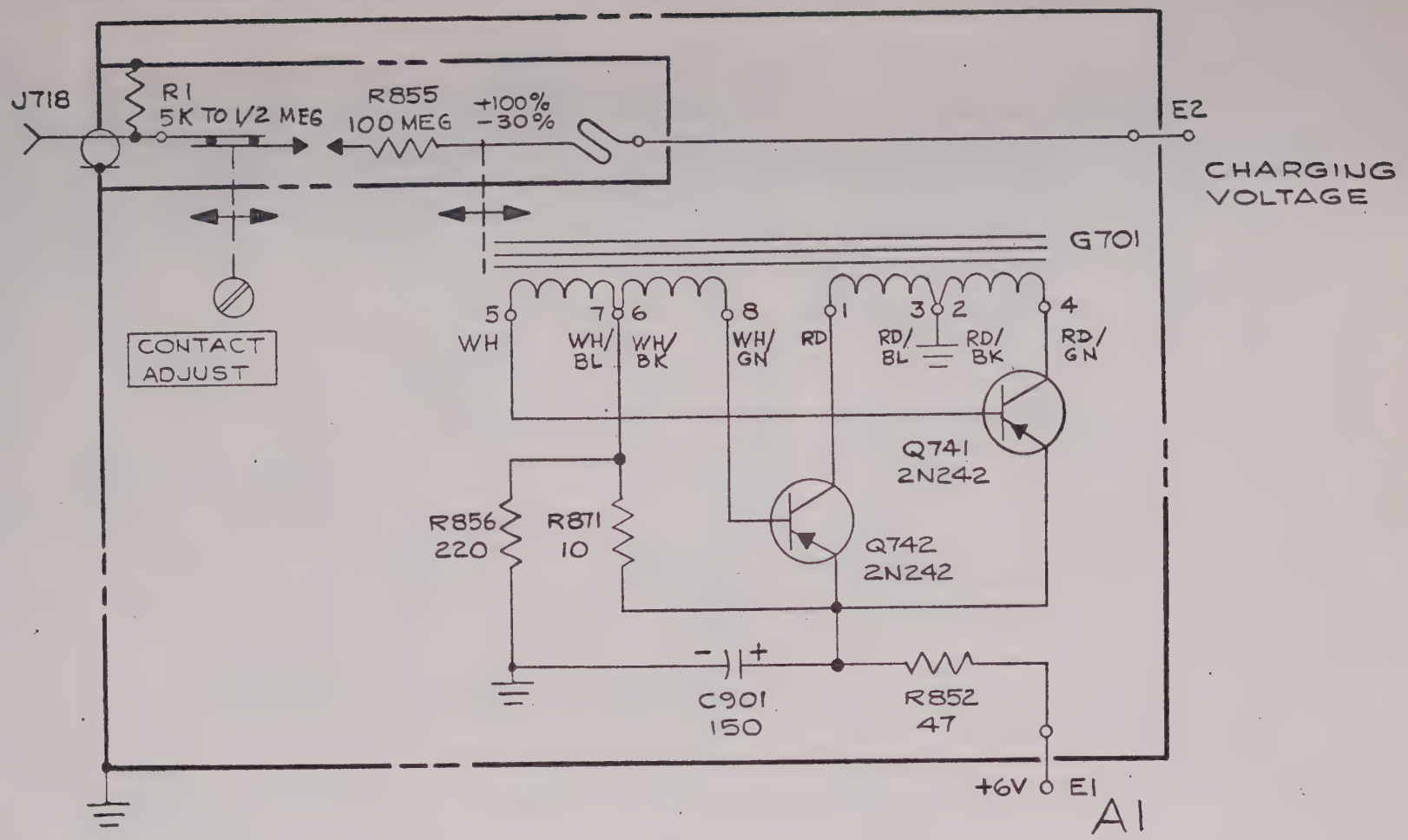

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTANCE VALUES ARE IN OHMS ± 5%, 1/2W.
2. * NOMINAL (FACTORY SELECTED).

NOTES UNLESS OTHERWISE SPECIFIED

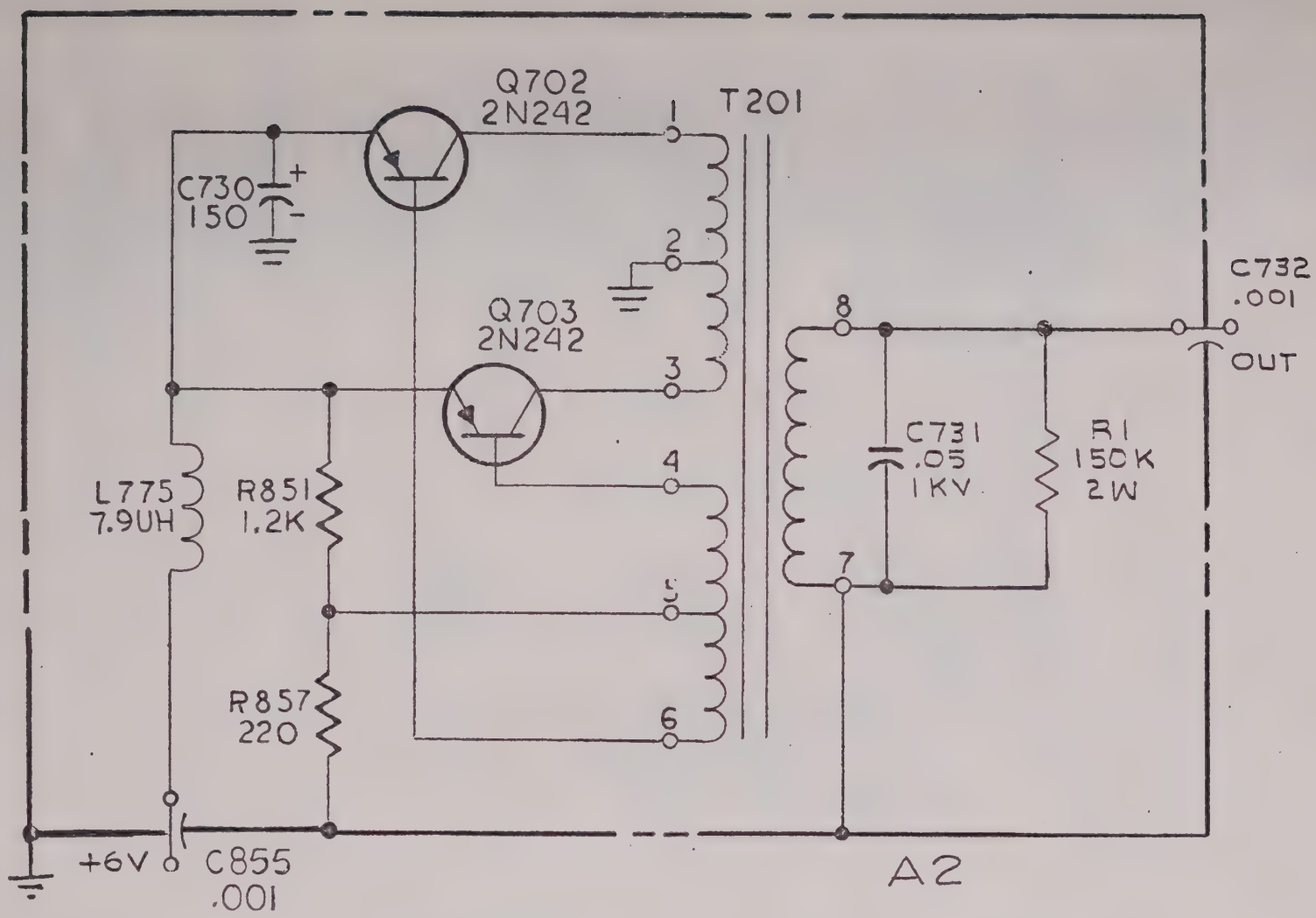



Schematic Diagram, Interconnecting Circuitry (Sheet 3 of 3)

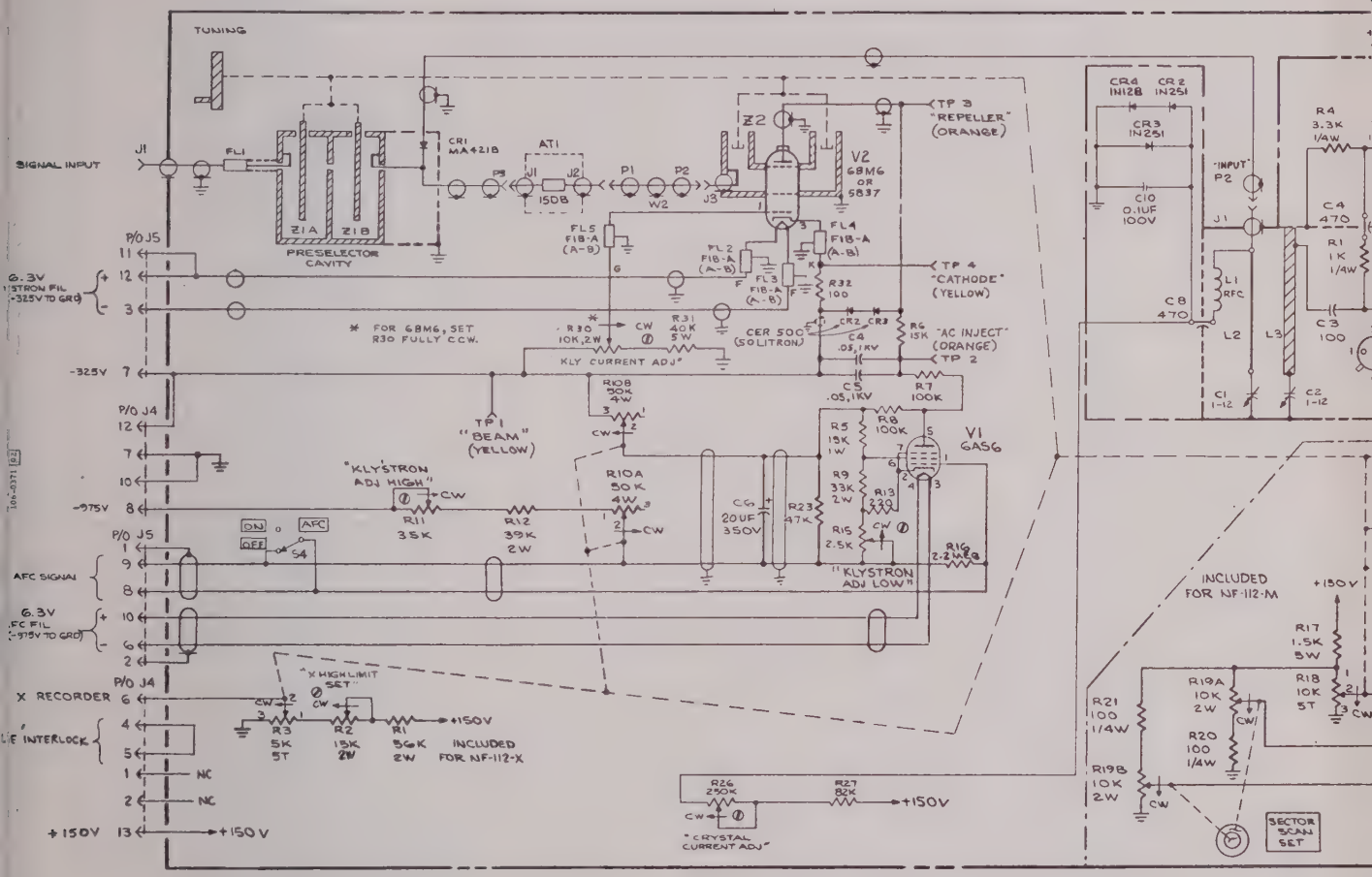



2. CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS
   ± 5%, 1/2 W.

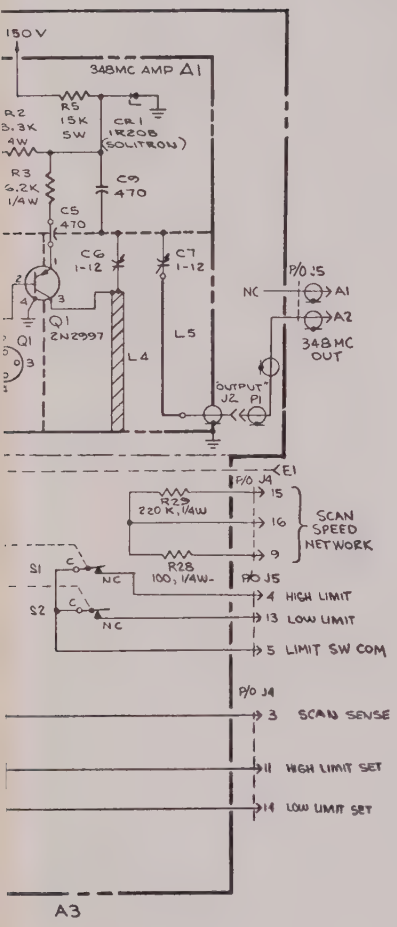
Schematic Diagram, Impulse Generator Driver (A1)



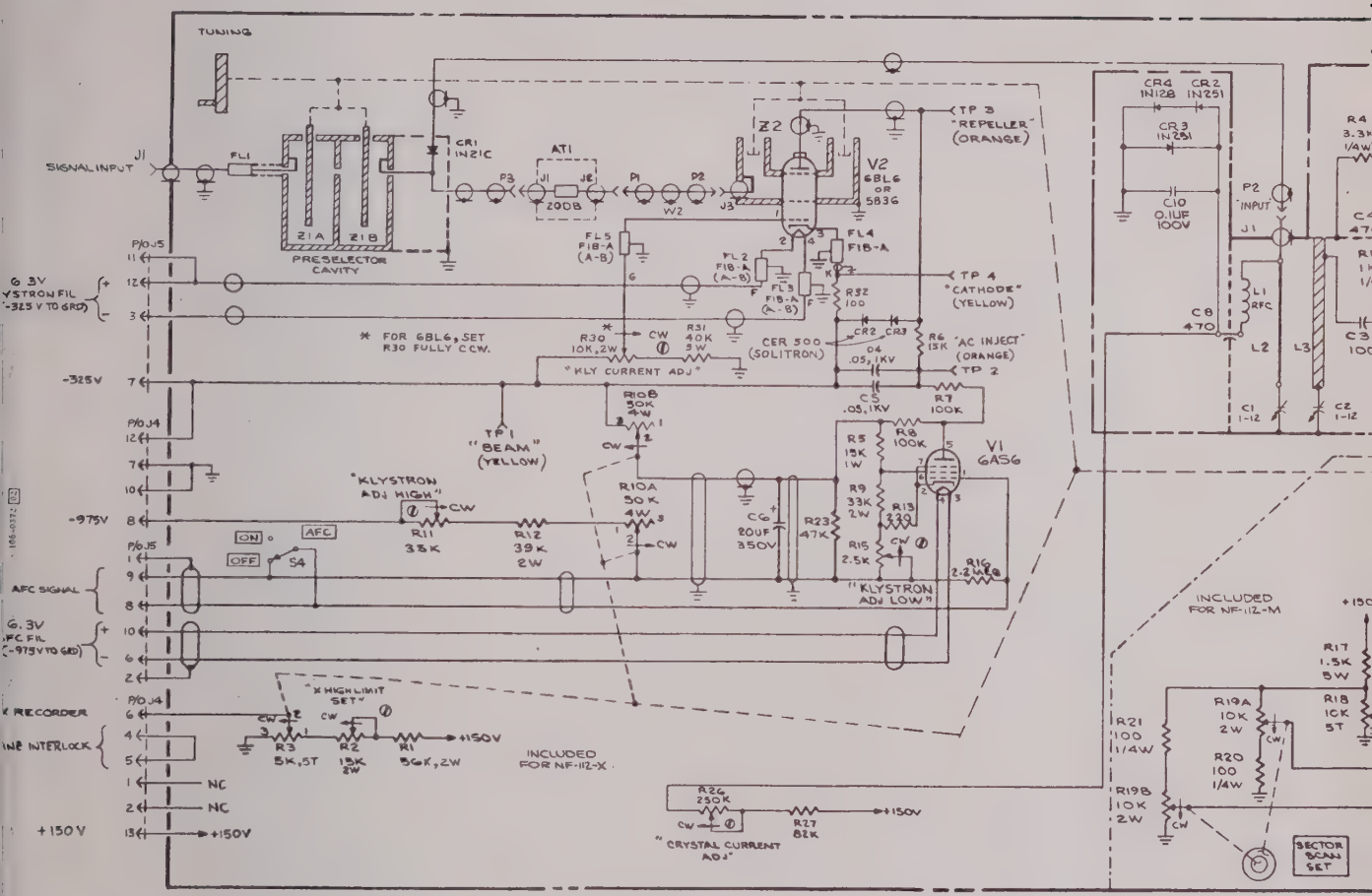

Schematic Diagram, Impulse Generator Charging Voltage (A2)



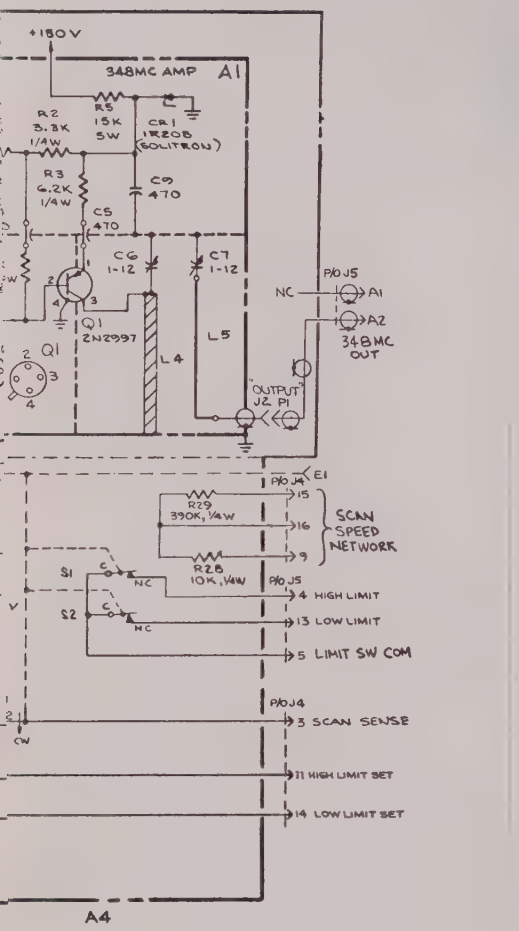

EQ RANGE: 1 TO 2 Gc/s.
L CAPACITANCE VALUES ARE IN PF.
L RESISTANCE VALUES ARE IN OHMS ± 5 %, 1/2W.
SE OTHERWISE SPECIFIED



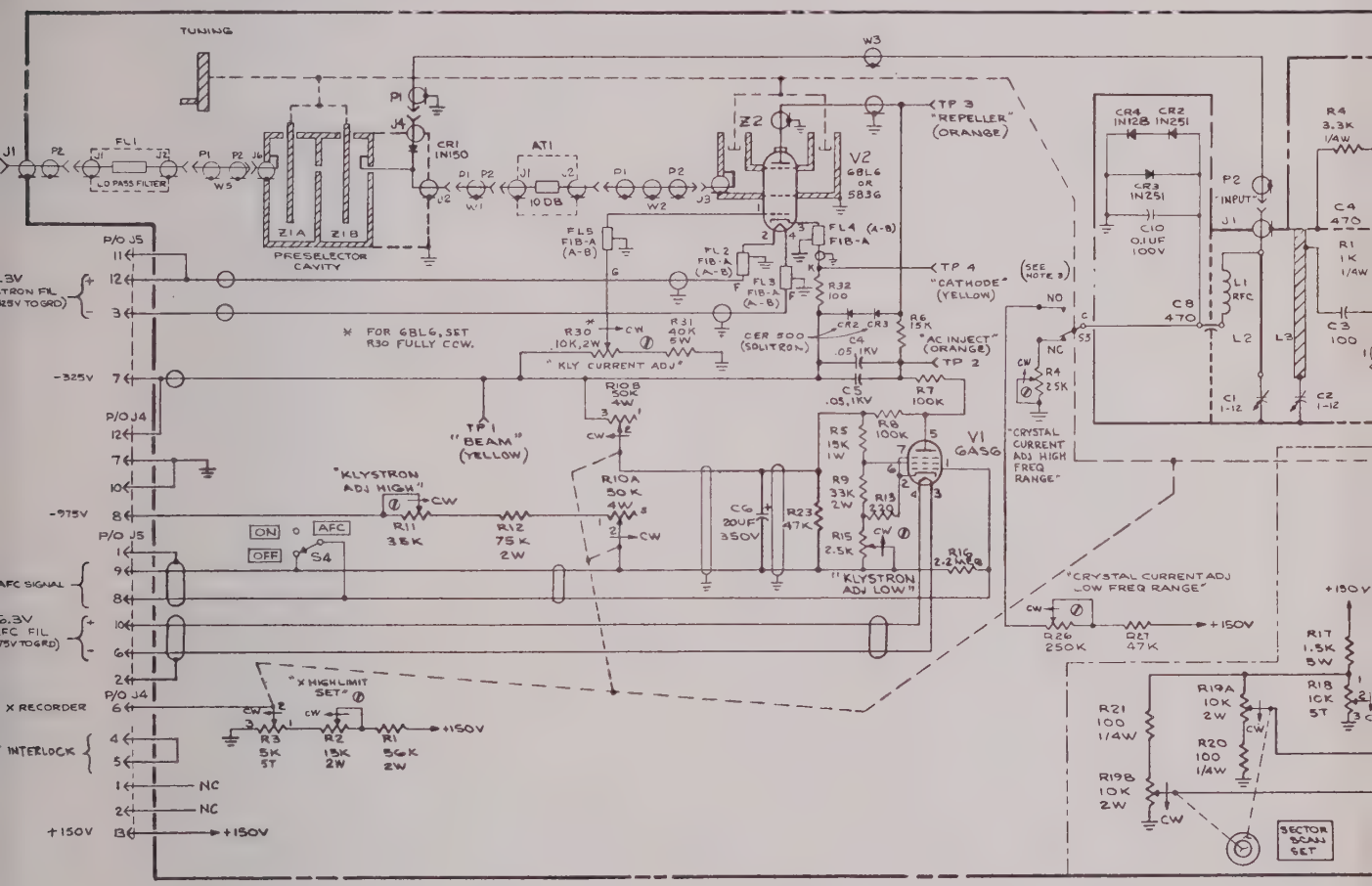

Schematic Diagram, Tuning Unit
T-1/NF-112 (A3)



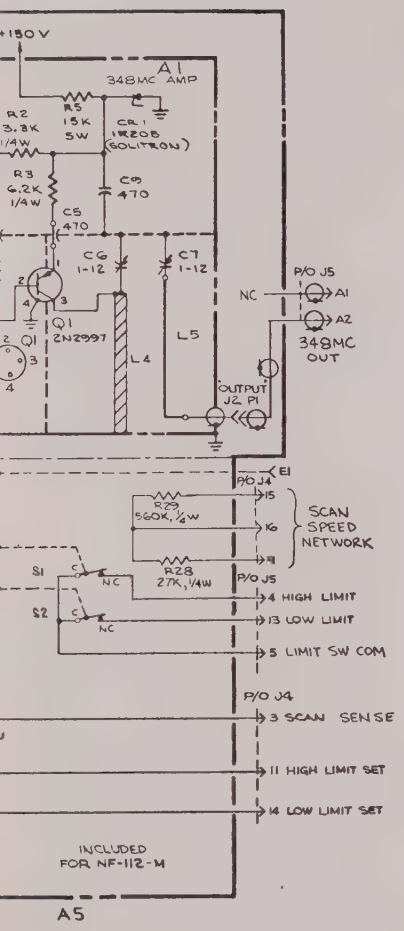

EQ RANGE: 2 TO 4 Gc/s.
L CAPACITANCE VALUES ARE IN PF.
L RESISTANCE VALUES ARE IN OHMS ± 5%, 1/2W.



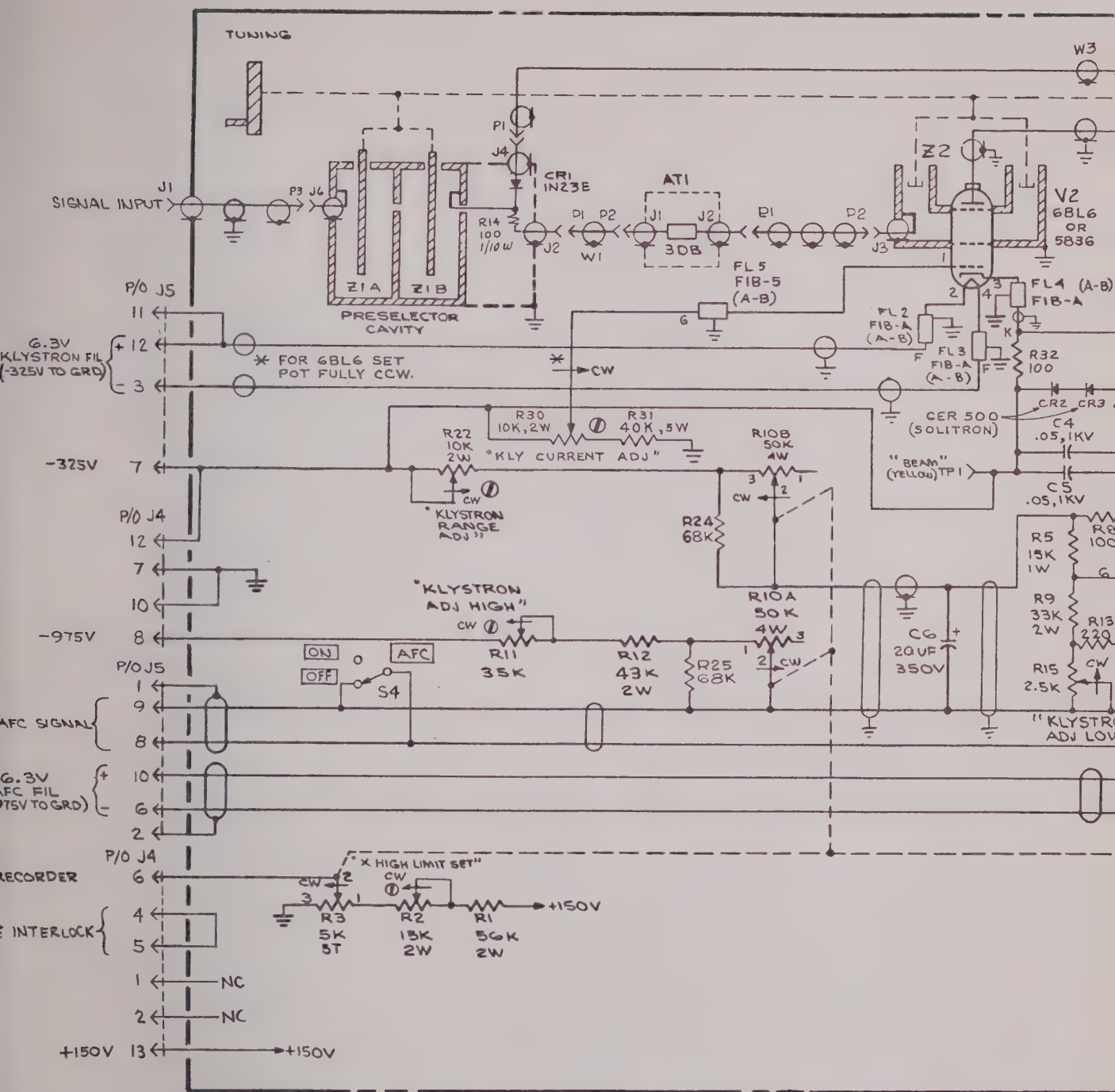

Schematic Diagram, Tuning Unit
T-2/NF-112 (A4)




Q RANGE: 4 TO 7 Gc/s.
ITCH S3 IN NC POSITION ABOVE 5 Gc/s.
L CAPACITANCE VALUES ARE IN PF.
RESISTANCE VALUES ARE IN OHMS ± 5%, 1/2W.




Schematic Diagram, Tuning Unit
T-3/NF-112 (A5)

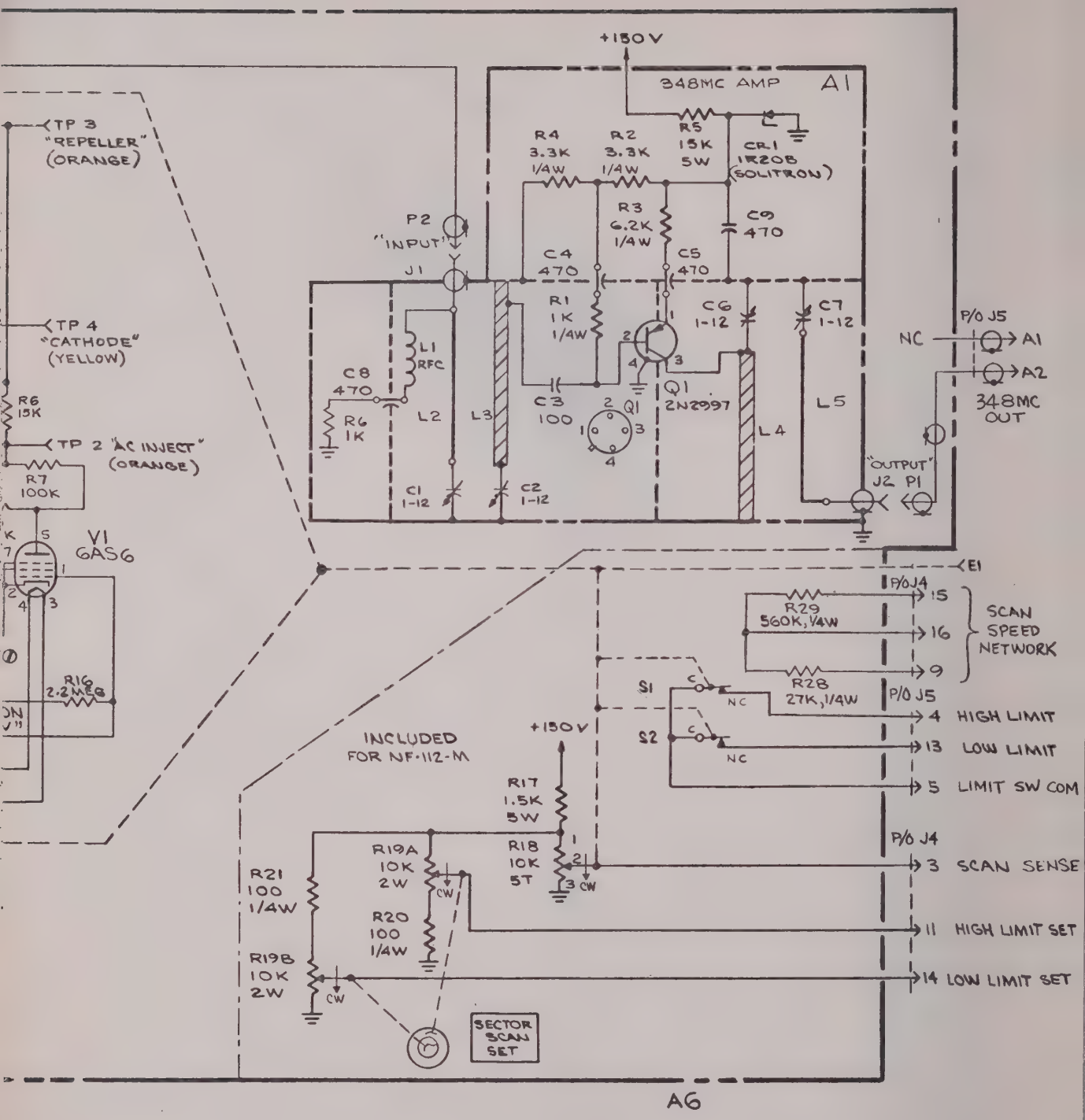



Q RANGE : 7 TO 10 Gc/s.

CAPACITANCE VALUES ARE IN PF.

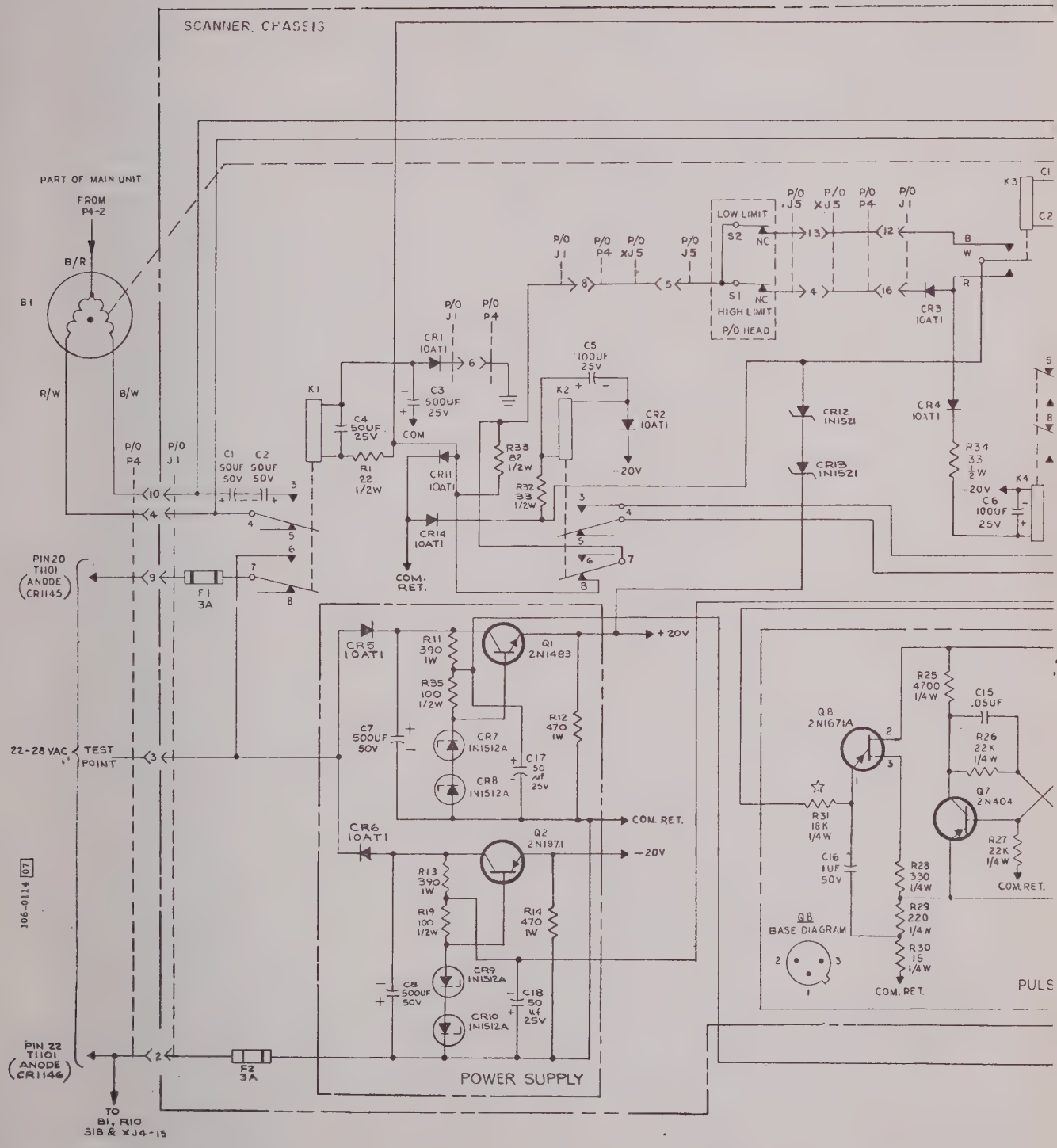
RESISTANCE VALUES ARE IN OHMS ± 5 %, 1/2W.

OTHERWISE SPECIFIED

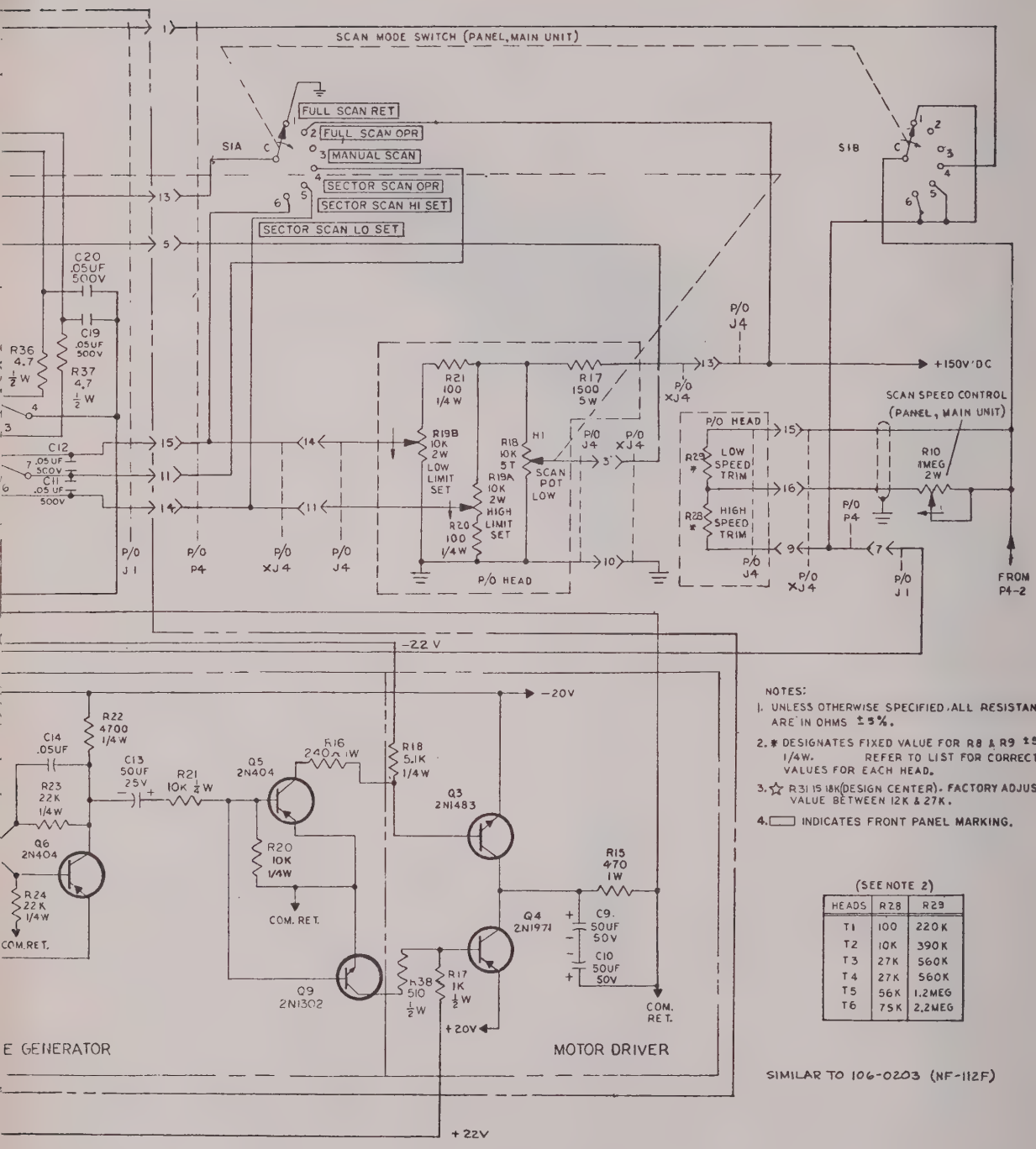



A6

Schematic Diagram, Tuning Unit
T-4/NF-112 (A6)




NOTES: UNLESS OTHERWISE SPECIFIED




NOTES:

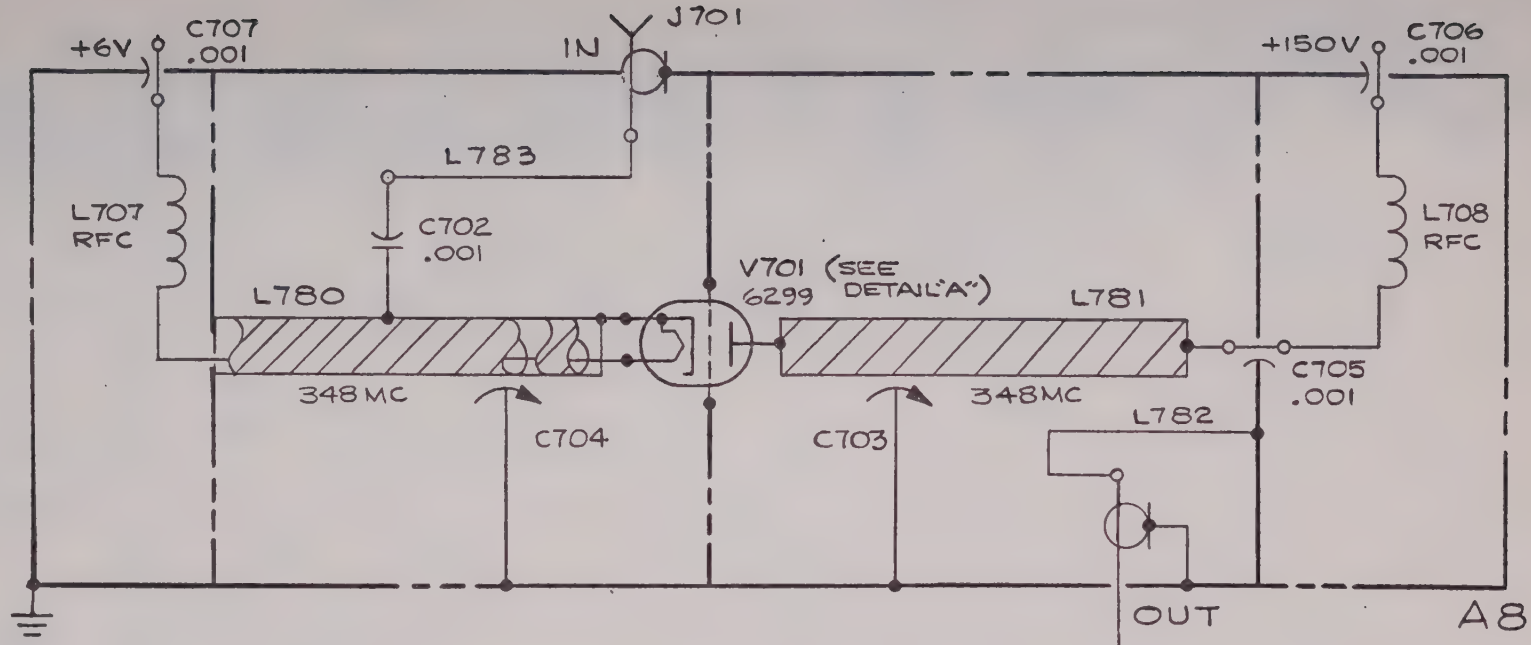
1. UNLESS OTHERWISE SPECIFIED, ALL RESISTANCES ARE IN OHMS ±5%.
2. * DESIGNATES FIXED VALUE FOR R8 & R9 ±5%, 1/4W. REFER TO LIST FOR CORRECT VALUES FOR EACH HEAD.
3. ☆ R31 IS 18K (DESIGN CENTER). FACTORY ADJUST VALUE BETWEEN 12K & 27K.
4. ▭ INDICATES FRONT PANEL MARKING.

(SEE NOTE 2)

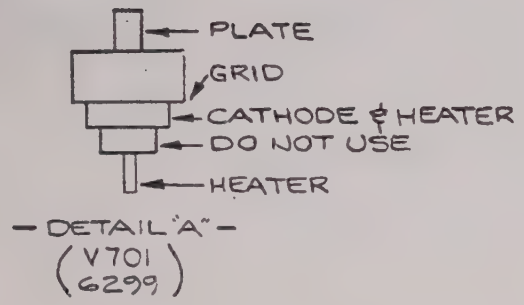
| HEADS | R28 | R29 |
|---|---|---|
| T1 | 100 | 220K |
| T2 | 10K | 390K |
| T3 | 27K | 560K |
| T4 | 27K | 560K |
| T5 | 56K | 1.2MEG |
| T6 | 75K | 2.2MEG |

SIMILAR TO 106-0203 (NF-112F)

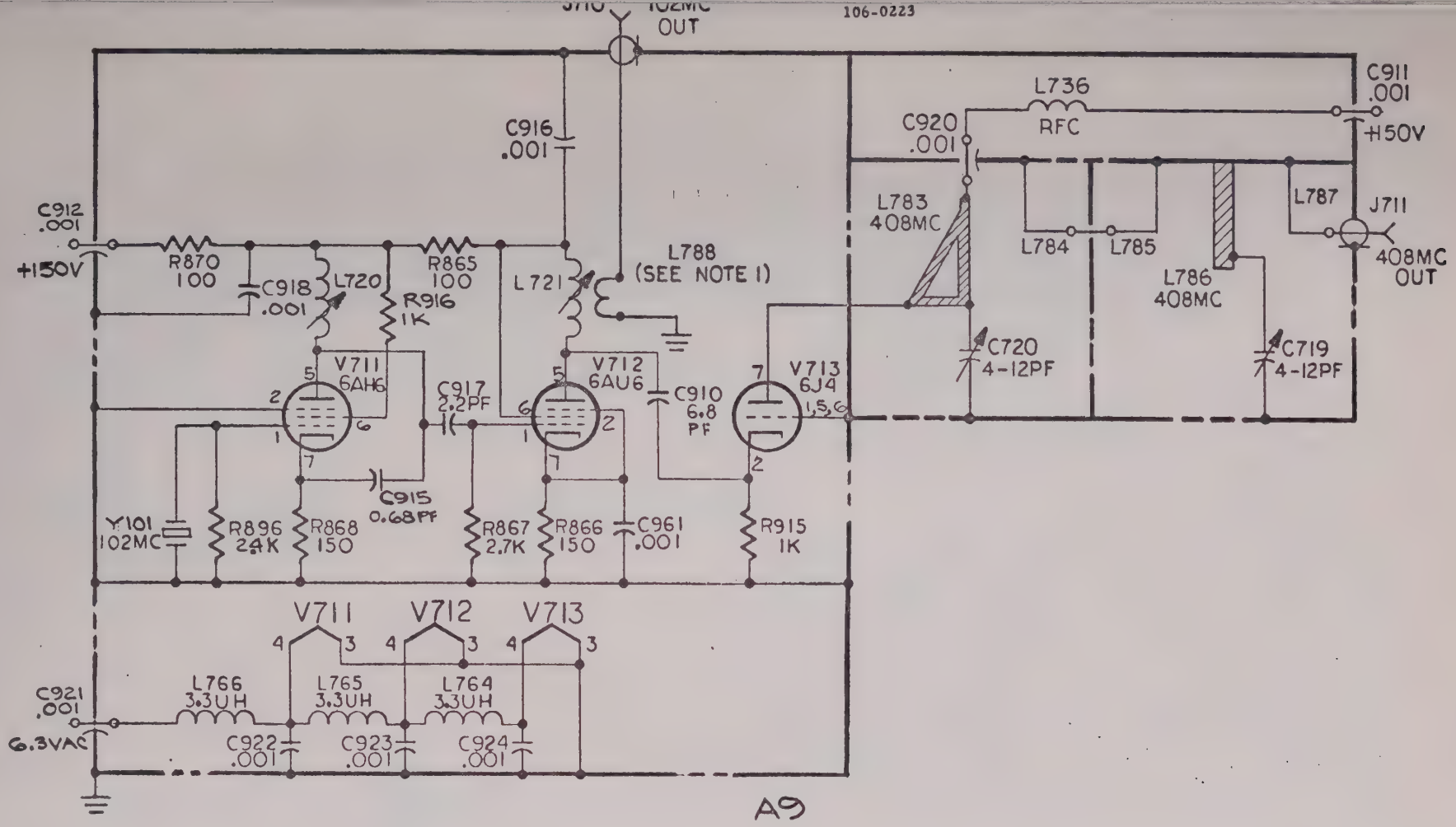
Schematic Diagram, Scanner Chassis (A7)




1. CAPACITANCE VALUES ARE IN UF.

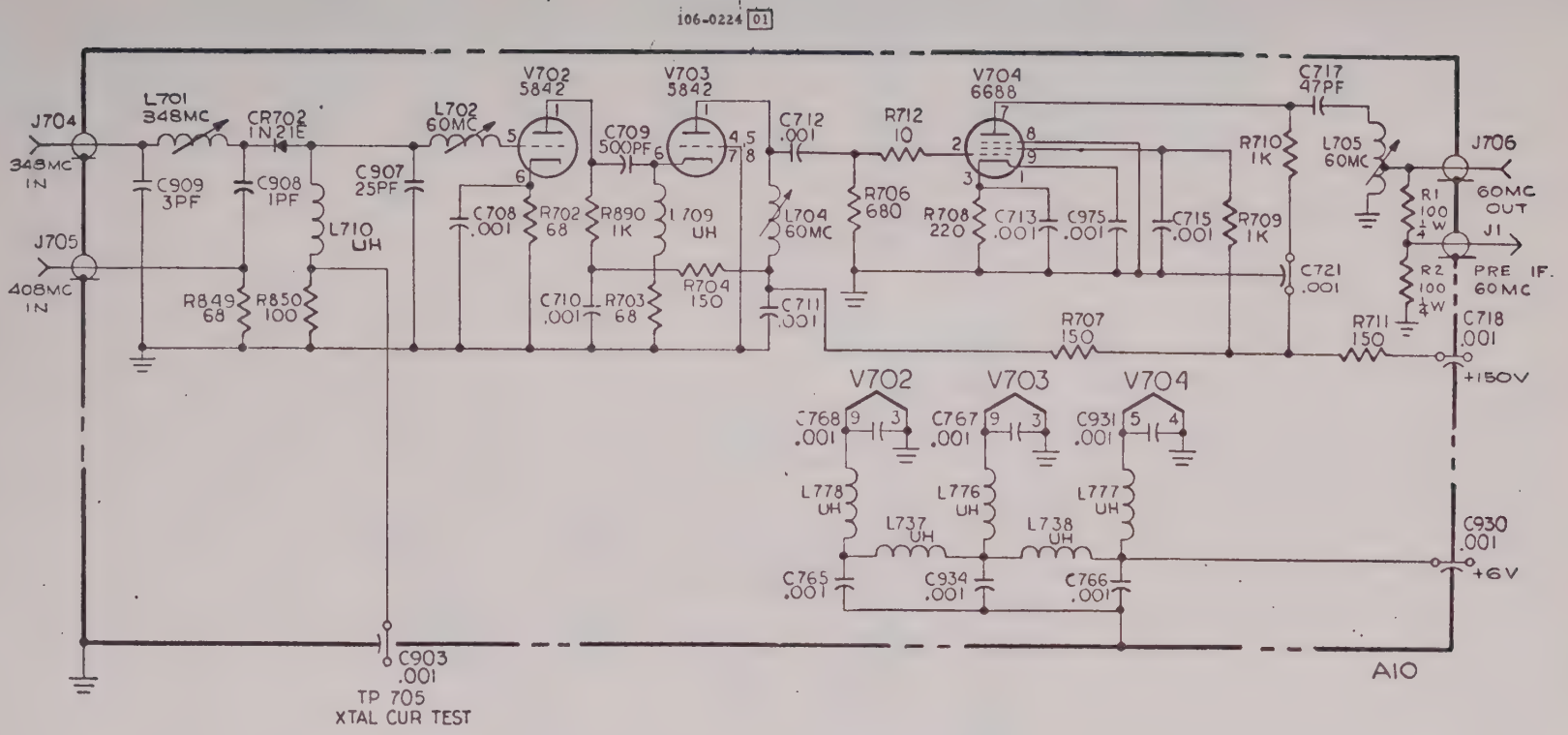



Schematic Diagram, 348 MC Postamp (A8)

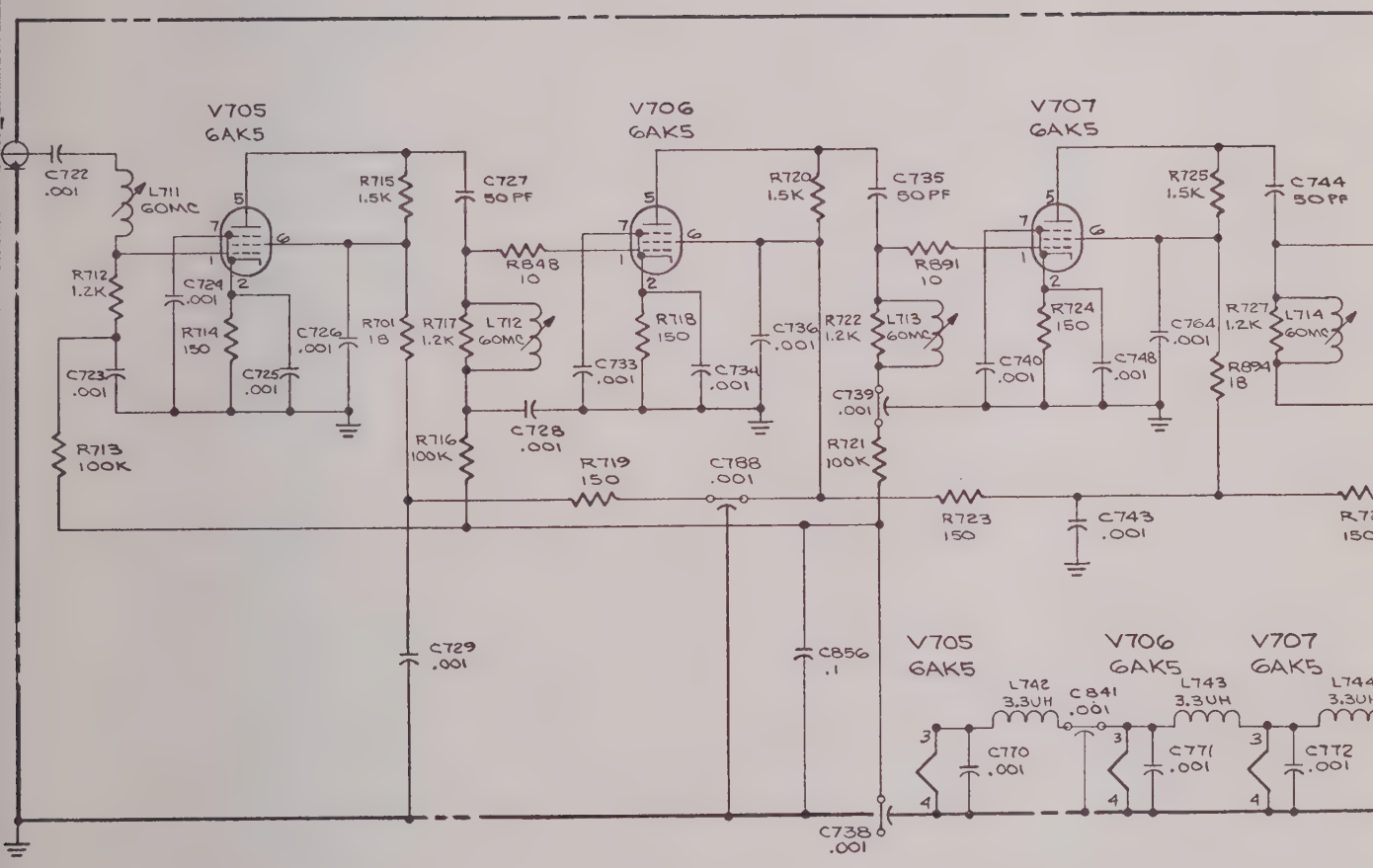



3. CAPACITANCE VALUES ARE IN U F.
2. RESISTANCE VALUES ARE IN OHMS ± 5%, ½W.
1. COUPLING LOOP L788 TO BE INSTALLED AT ASSY.

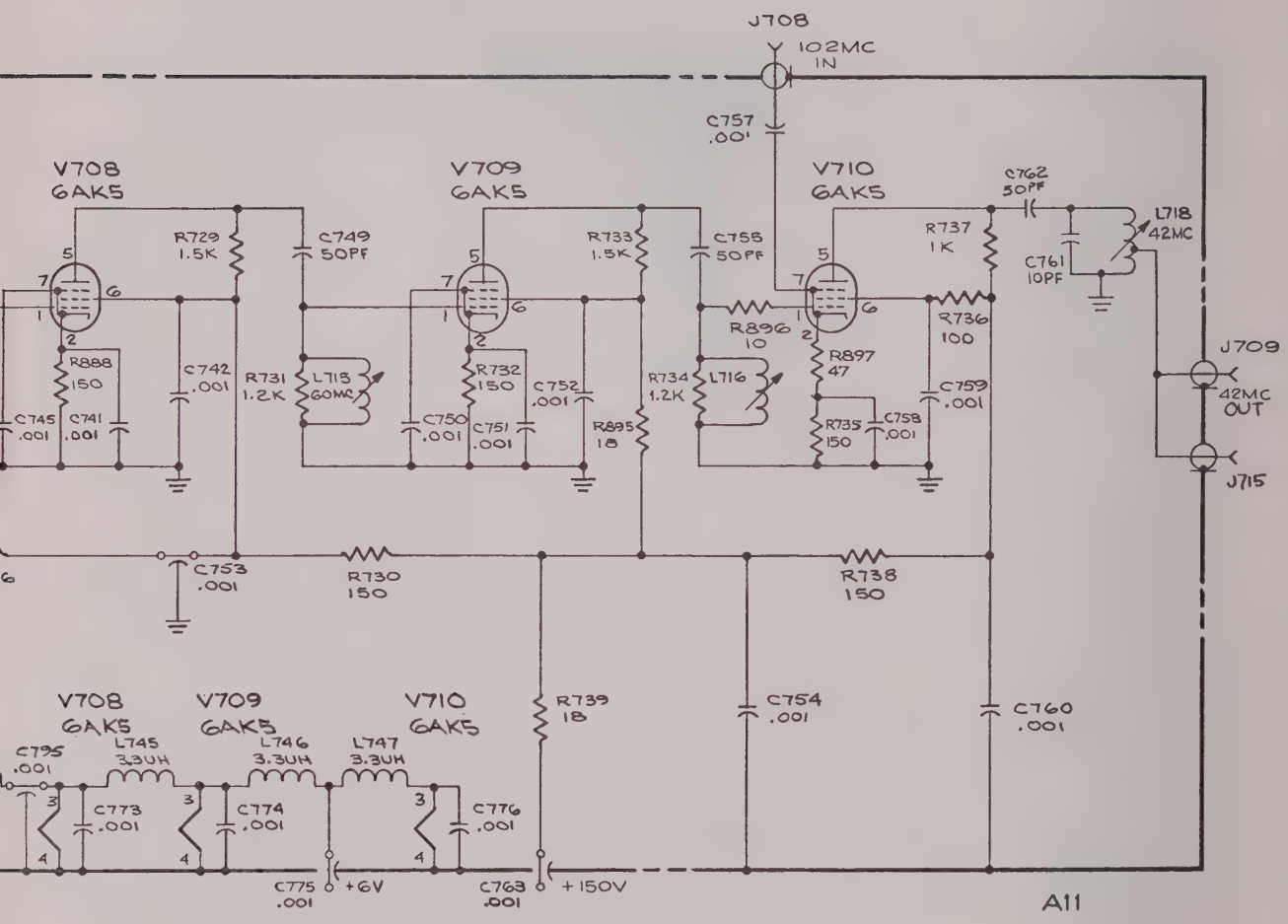
Schematic Diagram, Crystal Local Oscillator (A9)



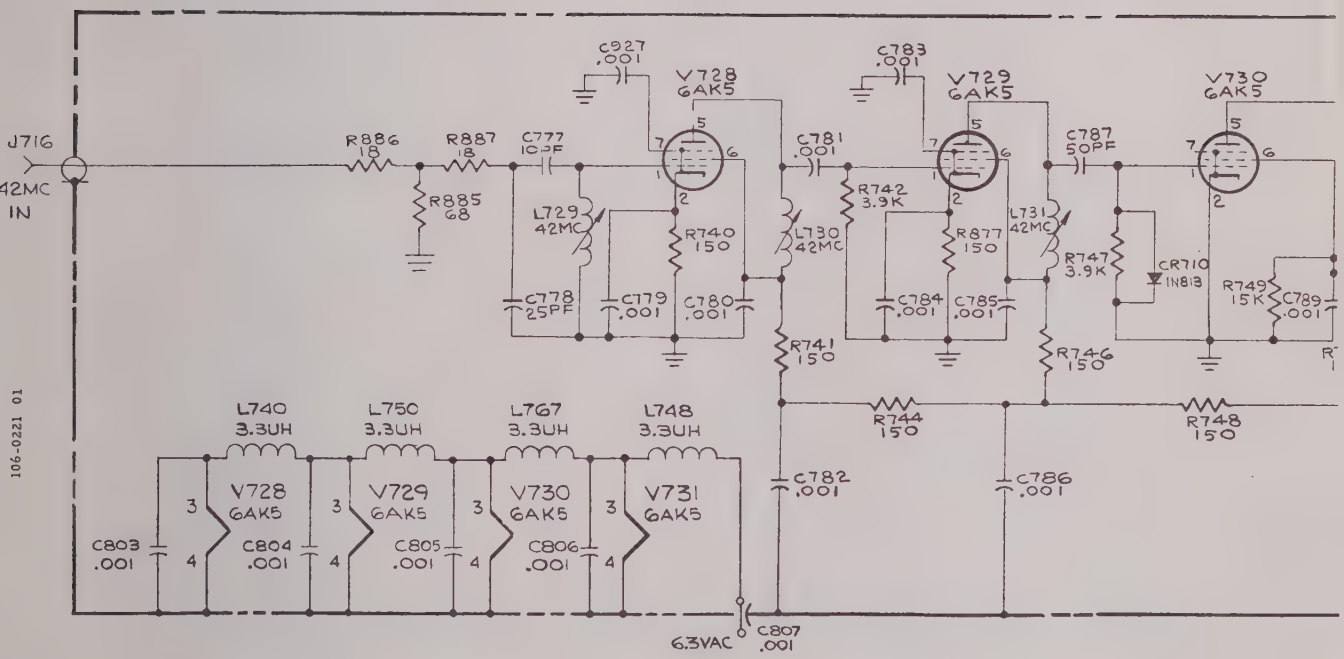

Schematic Diagram, 60 MC Mixer Preamp (A10)




2. ALL CAPACITANCE VALUES ARE IN UF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

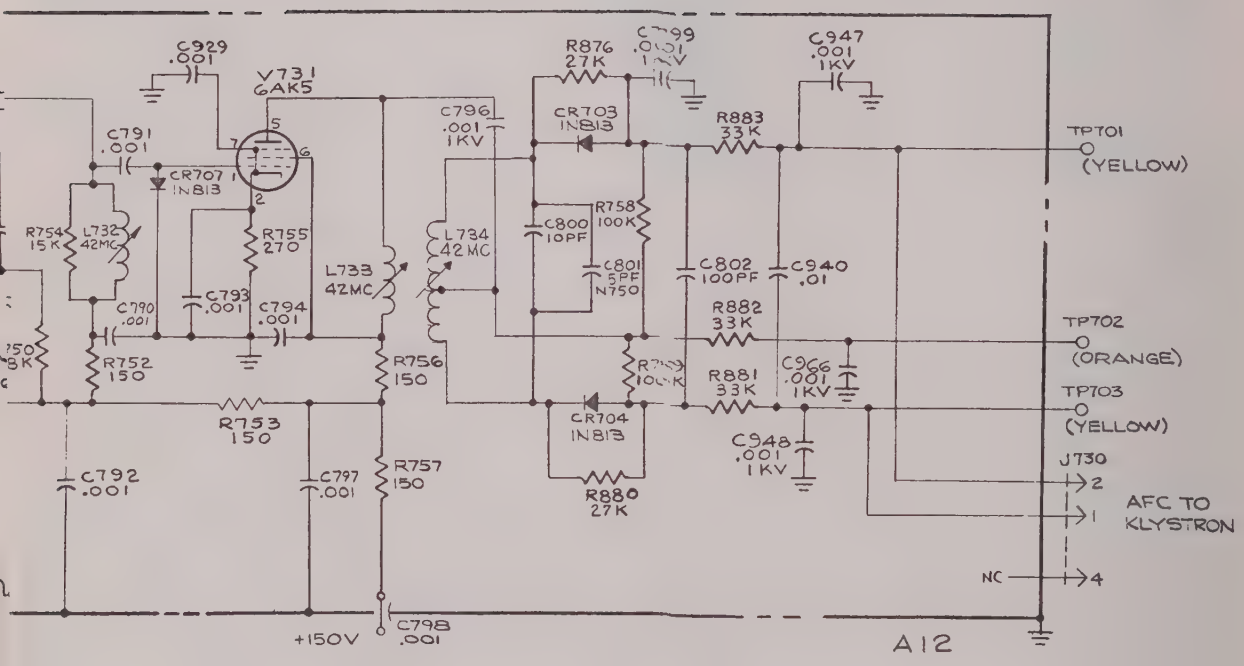



Schematic Diagram, 60 MC
IF Amp (A11)

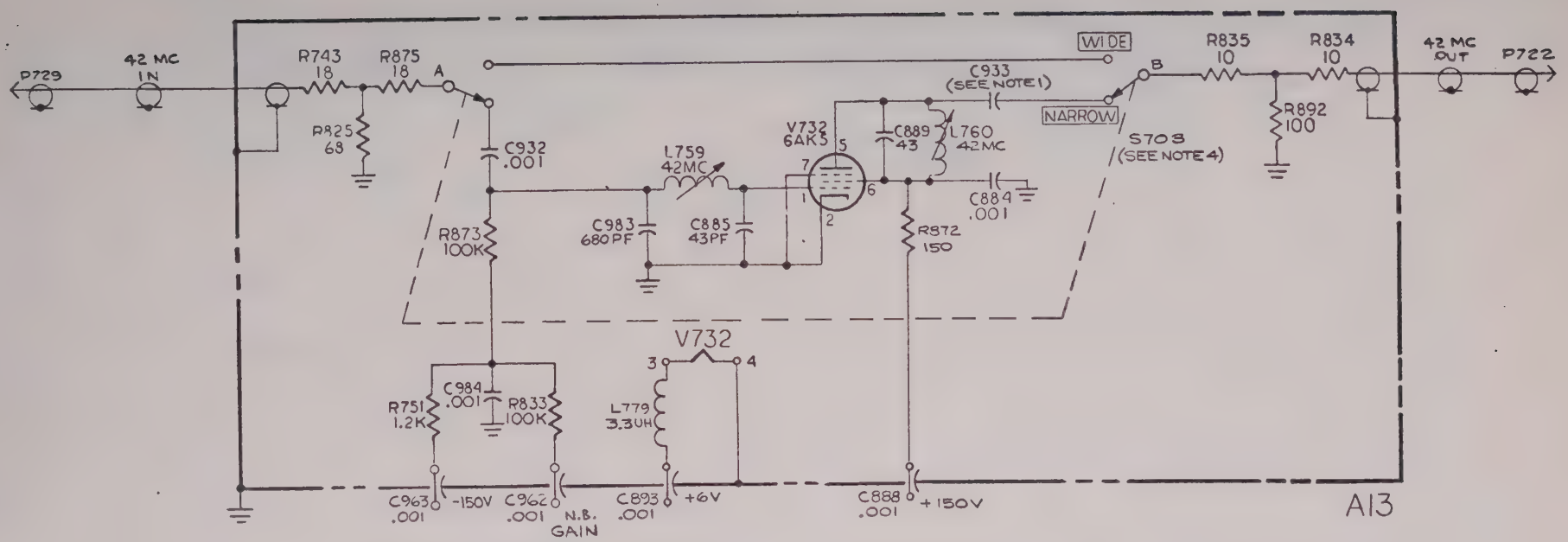



106-0221 01

2. CAPACITANCE VALUES ARE IN UF.
1. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2W.

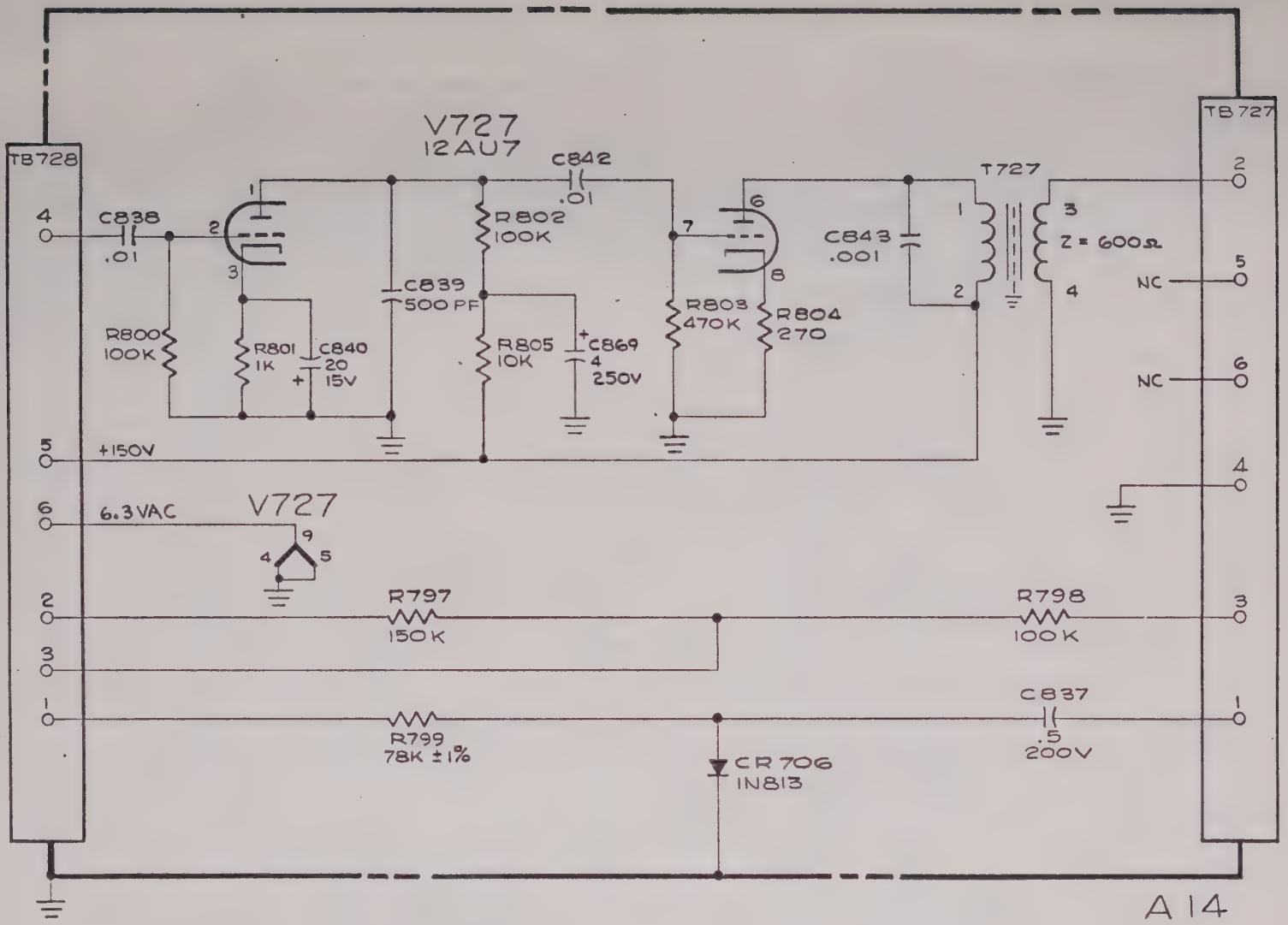



Schematic Diagram,
AFC Chassis (A12)



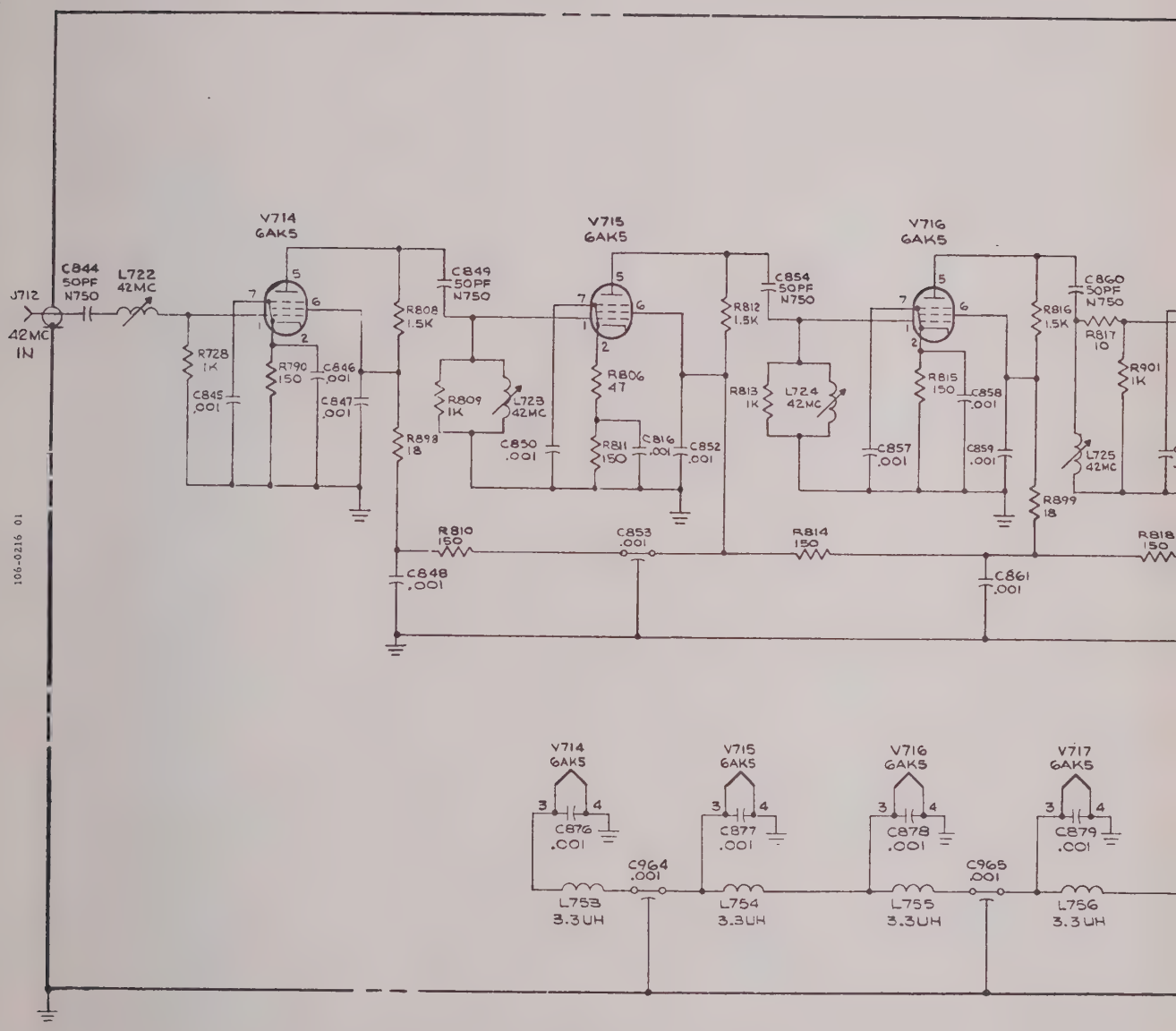

4. ON NF-112, -M; -X WIDE IS FULLY CLOCKWISE. (REF. 103-0437-001)
   ON NF-112-F NARROW IS FULLY CLOCKWISE. (REF. 103-0437-002)
3. CAPACITANCE VALUES ARE IN UF.
2. RESISTANCE VALUES ARE IN OHMS ±5%, 1/2 W.
1. FACTORY SELECTED: 2 TO 10 PF.

Schematic Diagram, Bandwidth Control A13)

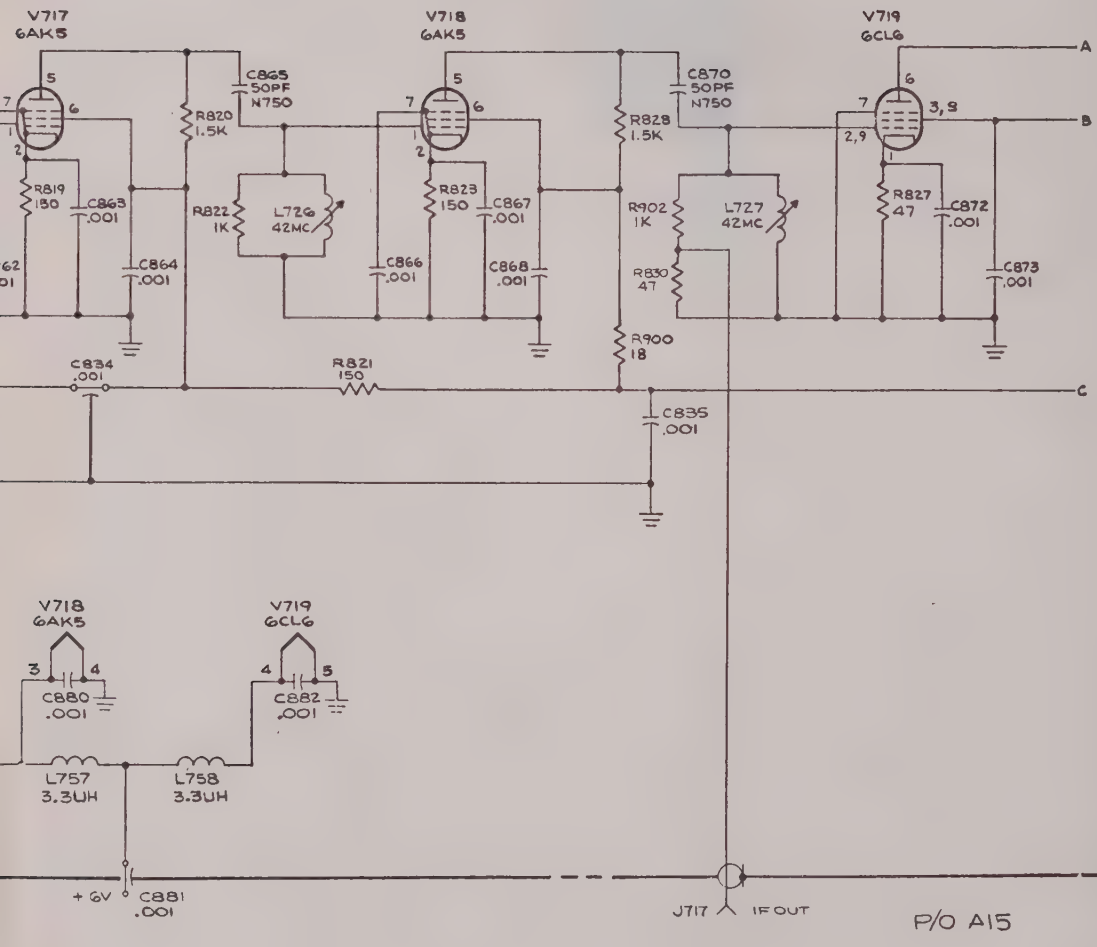



2. CAPACITANCE VALUES ARE IN UF.
1 RESISTANCE VALUES ARE IN OHMS ± 5%, 1/2W.

Schematic Diagram, Audio Amp (A14)

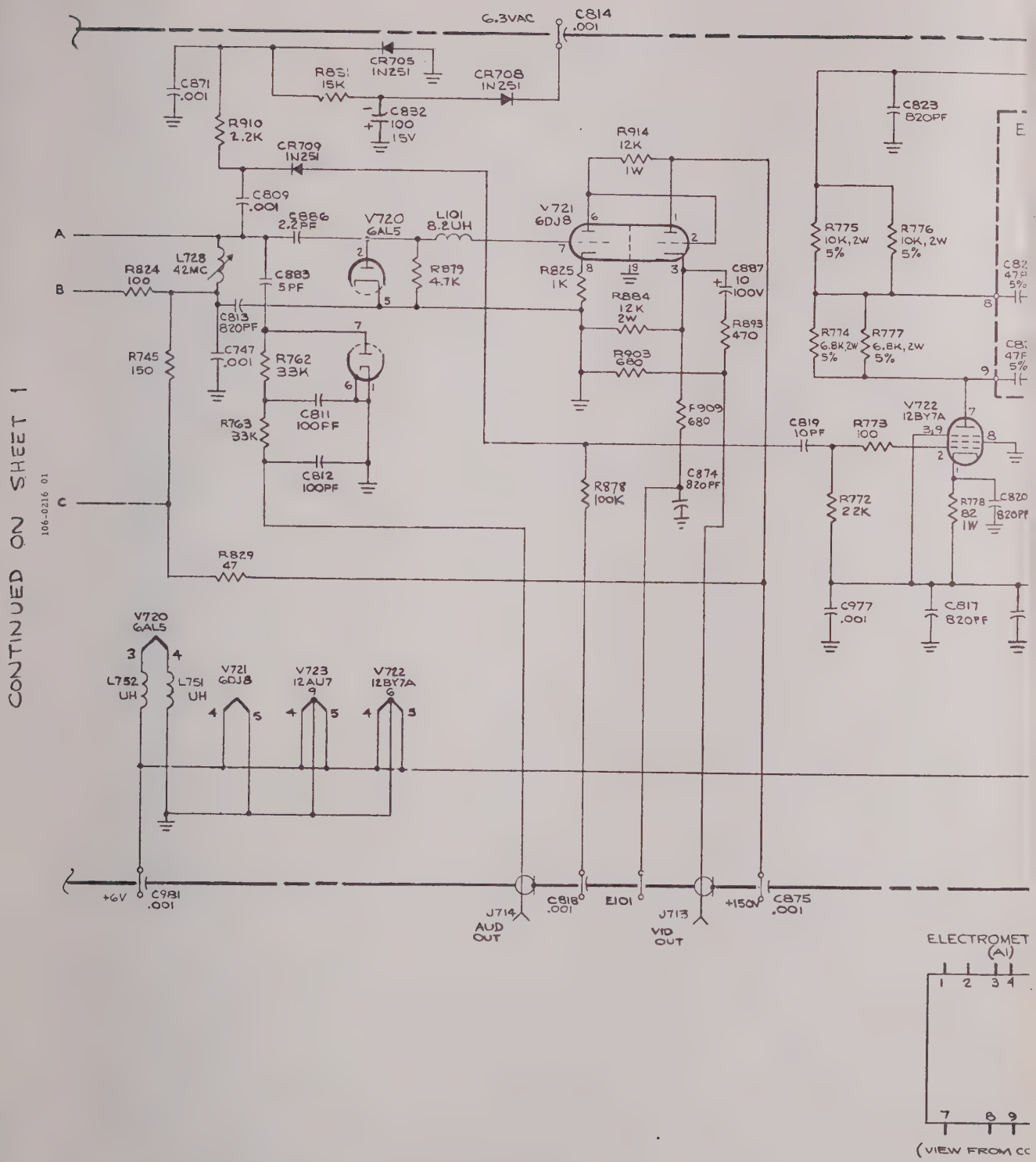


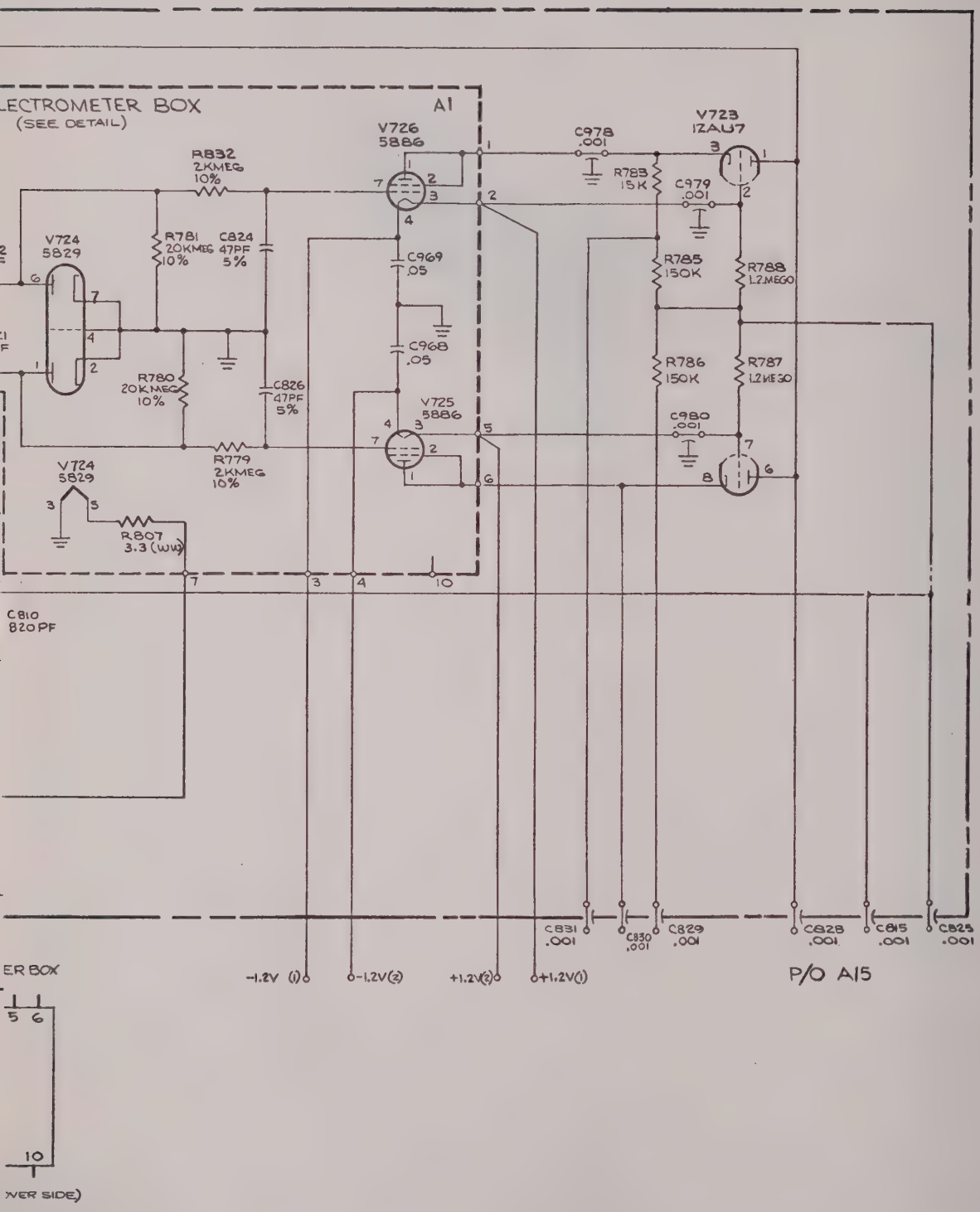

2. ALL CAPACITANCE VALUES ARE IN UF.
1. ALL RESISTANCE VALUES ARE IN OHMS ±5%, 1/2 W.



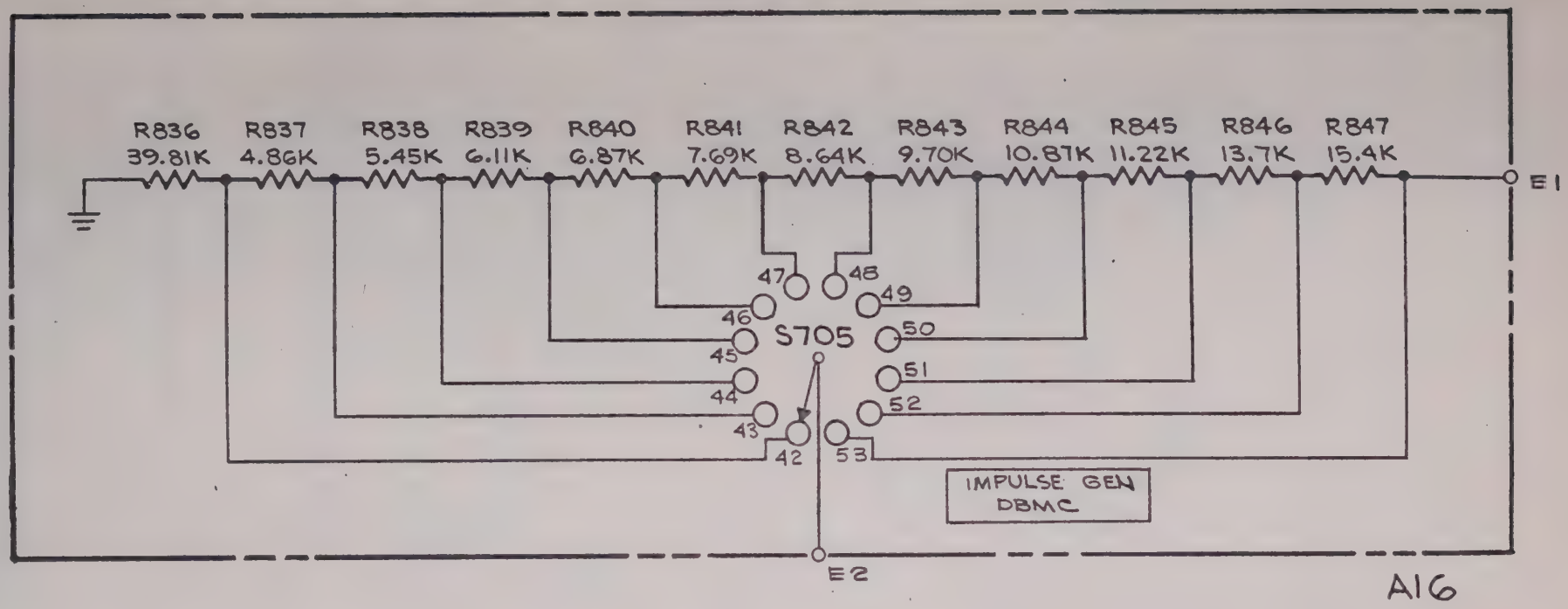

CONTINUED ON SHEET 2

Schematic Diagram, Tuning Unit and Metering (A15) (Sheet 1 of 2)


CONTINUED ON SHEET 1
106-0216 01
6.3VAC
C814 .001
CR705 1N251
R851 15K
CR708 1N251
C871 .001
C832 100 15V
R910 2.2K
CR709 1N251
C809 .001
C886 2.2PF
V720 6AL5
L101 8.2UH
L728 42MC
R824 100
C883 5PF
R879 4.7K
C813 820PF
R745 150
C747 .001
R762 33K
C811 100PF
R763 33K
C812 100PF
R829 47
V721 6DJ8
R914 12K 1W
R825 1K
R884 12K 2W
R903 680
C887 10 100V
R893 470
F909 680
C874 820PF
R878 100K
C819 10PF
R773 100
V722 12BY7A
R772 2.2K
R778 82 1W
C820 820PF
C977 .001
C817 820PF
C823 820PF
R775 10K, 2W 5%
R776 10K, 2W 5%
R774 6.8K 2W 5%
R777 6.8K, 2W 5%
V720 6AL5
L752 UH
L751 UH
V721 6DJ8
V723 12AU7
V722 12BY7A
+6V
C981 .001
J714 AUD OUT
C818 .001
E101
J713 VID OUT
+150V
C875 .001
ELECTROMET
(A1)
1 2 3 4
7 8 9
(VIEW FROM CC

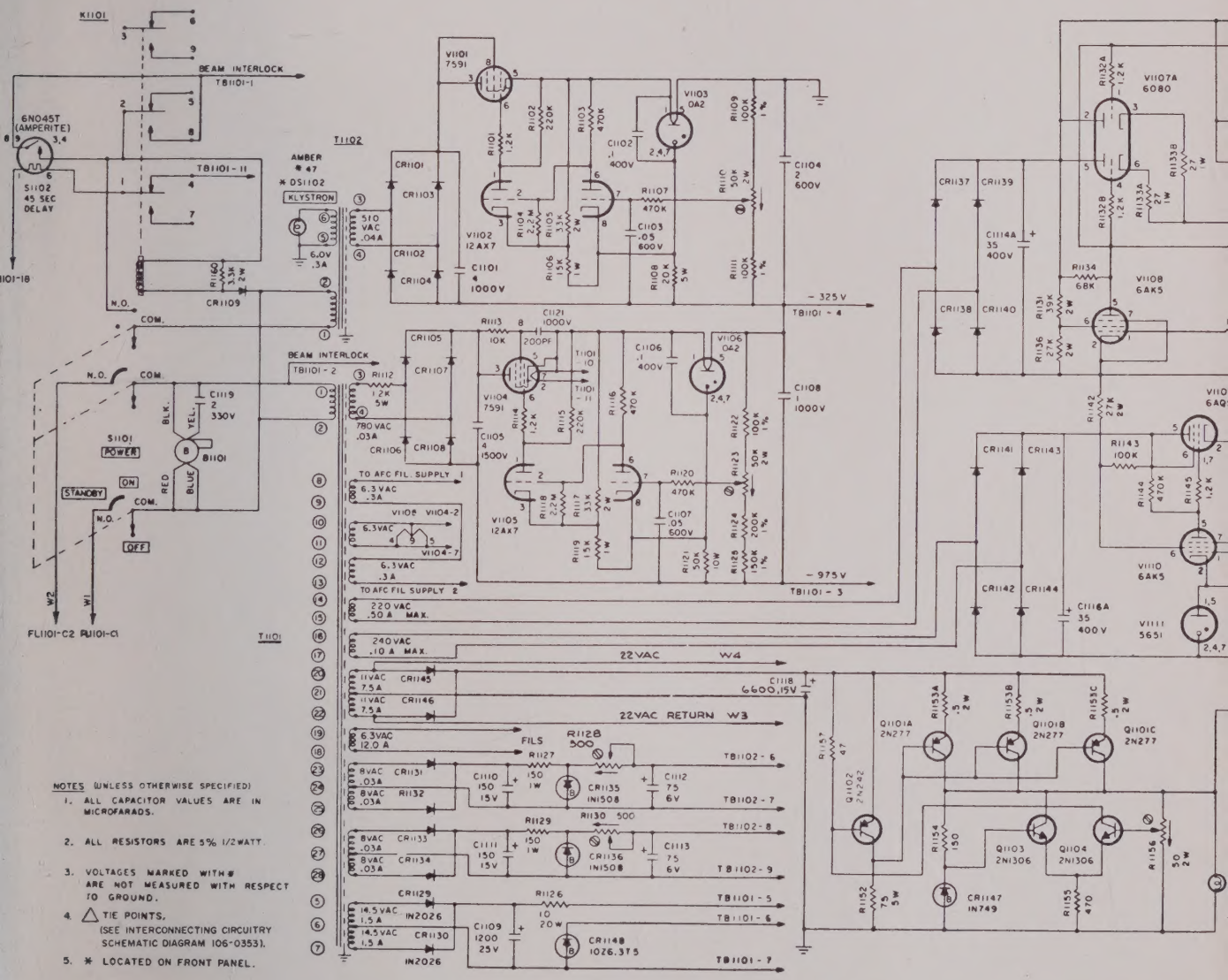



Schematic Diagram, 42 MC Amp and Metering (A15) (Sheet 2 of 2)



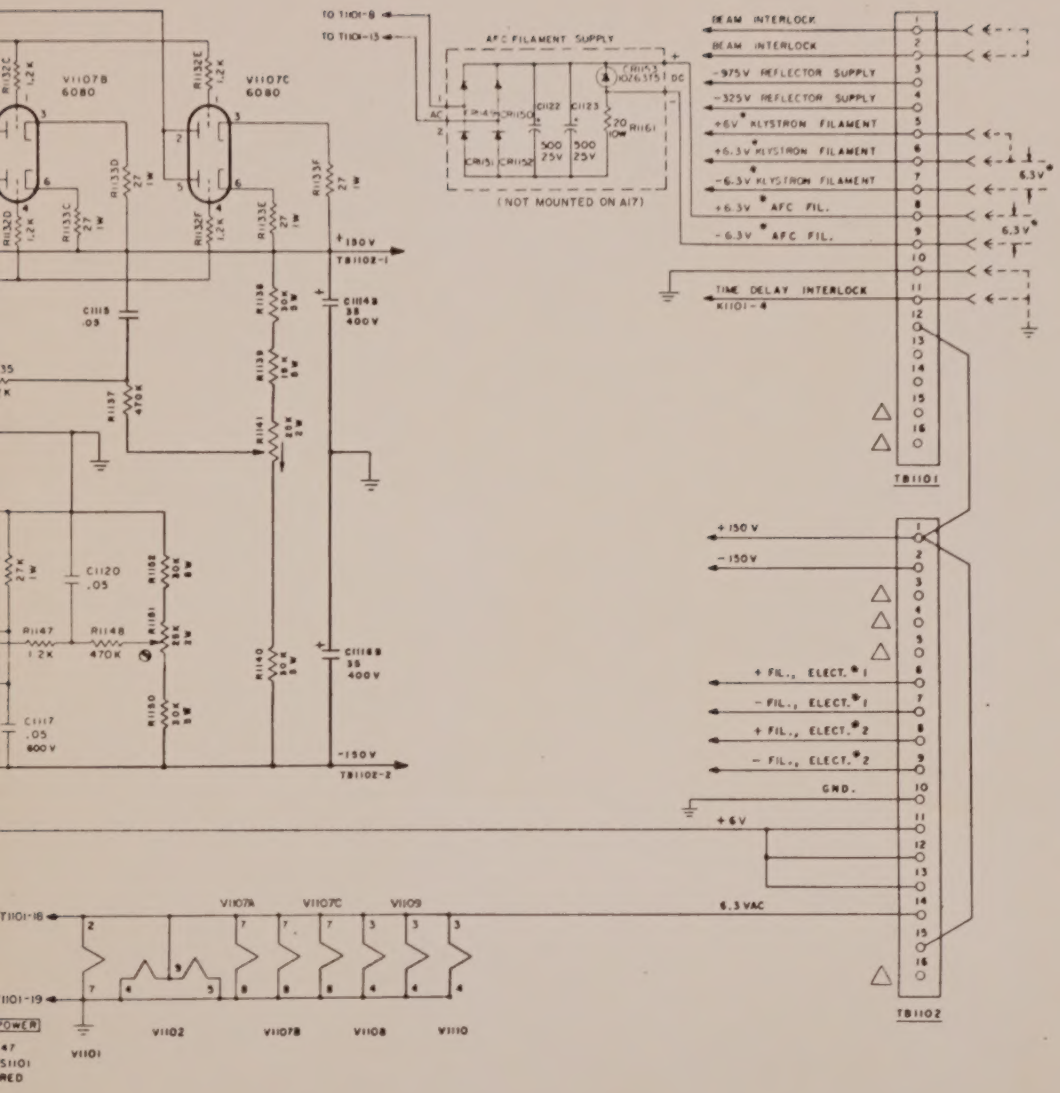

1. ALL RESISTANCES ARE IN OHMS ± 1%, 1/2W.

Schematic Diagram, Impulse Generator Attenuator (A16)




NOTES (UNLESS OTHERWISE SPECIFIED)

1. ALL CAPACITOR VALUES ARE IN MICROFARADS.
2. ALL RESISTORS ARE 5% 1/2WATT.
3. VOLTAGES MARKED WITH # ARE NOT MEASURED WITH RESPECT TO GROUND.
4. △ TIE POINTS. (SEE INTERCONNECTING CIRCUITRY SCHEMATIC DIAGRAM 106-0353).
5. * LOCATED ON FRONT PANEL.




A17

Schematic Diagram, Power Supply (A17)